Measuring the adoption of ICT levels and the perceived impact on performance within the SME manufacturing sector in South Africa

By

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management specialising in Entrepreneurship and New Venture Creation

Johannesburg, 2014

ABSTRACT

The establishment and growth of Small Medium Enterprises (SMEs) in most economies have been attributed with a corresponding need and desire for these SMEs as catalysts for economic growth, unemployment reduction, etc. Various factors are also impacting on how SMEs can become competitive and one of these enablers is the adoption of ICT by SMEs to improve performance.

The purpose of this research was to establish the perceived relationship between the adoption by SMEs of Information Communication Technology (ICT) usage in the manufacturing sector in South Africa and its perceived impact on firm performance. The intended objective was to assess whether the perception of ICT adoption usage within SME's operating within a manufacturing sector will either have a positive or negative performance outcome.

The research methodology adopted was a quantitative approach which was guided by a positivist paradigm. The population targeted were SMEs in the manufacturing sector in South Africa but deliberately excluded SME manufacturers involved in the production of computers, electronics, etc. A combination of an online survey and paper questionnaire was utilised to gather data.

The adoption of ICT and the perceived impact on performance within SMEs in manufacturing in South Africa revealed some findings consistent with existing literature in terms of the overall accepted perception that ICT adoption has a perceived positive impact on firm performance, including but also not limited to market share, products and service innovation, etc. as measured in the research.

A deeper analysis is required to understand why the respondents in the research did not *overwhelmingly* state that ICT adoption has a perceived positive impact on performance, market share, product and service innovation etc.

DECLARATION

I, _____, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Lerato Motsoeneng

Signed at ……

On the …….. day of …… 2008

DEDICATION

This work is dedicated to my wife, Lorato Motsoeneng, and to our two beautiful children Kananelo and Leatile Motsoeneng. Thank you for keeping yourselves busy while I was working on my studies.

To my mother Matsiliso Moleko, I know you'll be proud of me.

To the rest of my family and friends for supporting me while on this learning journey, thank you for your patience and support.

ACKNOWLEDGEMENTS

I would like to thank Dr Jose Barreira for supervising my work and guiding me to completing my research report. I would also like to acknowledge Hennie Gerber for helping me with my data analysis; his patience and insight were really valuable appreciated. Harold Campbell, my friend and syndicate group member who was always there to provide me with insight and understanding when I had missed the boat during Decision Science and Research Methodology! I would also like to acknowledge my class mates for making this journey worthwhile; we certainly had some interesting times! Finally, thanks are due to Professor Boris Urban and Tozi Zeka for the continued support and encouragement along the way**.**

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CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to establish the relationship between the adoption by Small Medium Enterprises (SMEs) of Information Communication Technology (ICT) usage in the manufacturing sector in South Africa and its perceived impact on firm performance. The intended objective is to assess whether the adoption of ICT usage within SMEs operating within a manufacturing sector will have either a positive or negative performance outcome.

1.2 Context of the study

The establishment and growth of Small Medium Enterprises (SMEs) in most economies have been attributed to a corresponding need and desire for these SMEs as catalysts for economic growth, unemployment reduction, etc. (ITU, Cisco, & Development, 2013). Stated differently "Small and medium enterprises (SMEs) are increasingly seen as playing an important role in the economies of many countries. Thus, governments throughout the world focus on the development of the SME sector to promote economic growth" (Olawale & Garwe, 2010; p.729; (Hashim, 2007).

Various factors are also impacting how SMEs can become competitive including but not limited to globalisation, which makes it easy for SMEs to compete with each other across markets without ever needing to be in specific locations. One of the enablers of the latter has been attributed to the role of ICT (Modimogale & Kroeze, 2009). ICT enables the free movement of information which has been accelerated by globalisation and digitisation. The outcome is the transition into knowledge economies where businesses transact knowledge as a form of value exchange, the "forefront of organisational performance are the organisations which recognised that information, knowledge and their intelligent

application are the essential factors of success in the new economy, and take advantage of information technology to achieve high levels of efficiency and effectiveness" (Modimogale & Kroeze, 2009; p.505).

It is further argued that ICT has the potential to impact business performance (Pierson, Baelden, Lievens, & Marsigny, 2009). The role of ICT and broadband becomes ever crucial to SMEs' performance as economies transition from industrial to information economies/societies.

The converse effect may also be achieved with the use of ICT as a form of mechanisation which could negatively impact South Africa's prospects of creating labour-intensive jobs by replacing warm bodies with technology which could be deemed to be efficient and reliable (Isa, 2014). This rings true especially within a South African context where the manufacturing sector was hard hit by the strikes in 2013 (Isa, 2014)

Recent research by Terziovski (2010) also argues that SMEs in the manufacturing sector need to adopt innovative techniques to remain competitive. This is achieved by having a strong innovative culture which is linked to SMEs' organisation strategy. Innovation may be realised via the use of technology. In relation to SMEs in the manufacturing sector within a South African context, there is a gap in the research that measures the perceived adoption of ICT usage within SMEs in manufacturing and the impact on performance. Although South Africa is a developing country, the adoption of ICT usage within the formal economy is widely adopted, but there is room to understand better the adoption of ICT usage within SMEs in the manufacturing sector and the impact on performance.

The adoption of ICT may be defined as either primary or secondary (Pierson et al., 2009). The adoption of ICT in the primary process refers to the adoption of ICT in the production process while adoption of ICT in the secondary process refers to adoption of ICT as support and or administrative services (Pierson et al., 2009).

It is within this context of SMEs being regarded as a catalyst for economic growth and poverty alleviation, that this study examines how the adoption of ICT usage can catapult South African SMEs in the manufacturing sector to become much more productive with the aim of creating additional jobs, alleviating poverty, etc. The study should also contribute positively to entrepreneurial research by demonstrating how technology can be used as an enabler to improve firm performance hence becoming a necessary condition for firm sustainability when creating new ventures.

1.3 Problem statement

The use of ICT has been recognised as a catalyst for improving firm performance and enabling SMEs in manufacturing to be competitive and innovative(Terziovski, 2010) . There remains a gap in the literature to measure the adoption of ICT within SMEs in the manufacturing sector in South Africa and the impact this has on performance. It is envisaged that ICT adoption within SMEs in the manufacturing sector in South Africa could contribute to more competitive SMEs that may potentially create jobs, alleviate poverty and improve South Africa's competitiveness globally.

1.3.1 *Main problem*

The main problem examined is: *Measure the adoption of ICT usage and the perceived impact this has on performance within the SME manufacturing sector in South Africa.* This is further broken down into two sub-problems and

following the review of the relevant literature will be accompanied by the corresponding research question and hypotheses respectively.

1.3.2 *Sub-problems*

The first sub-problem is: *Measure the adoption of ICT usage within the SME manufacturing sector in South Africa.*

The second sub-problem is: *Evaluate the perceived impact of ICT adoption on performance within the SME manufacturing sector in South Africa.*

1.4 Significance of the study

The significance of the study is to provide knowledge about the adoption of ICT usage by SMEs and how this has a perceived impact on the SMEs' performance. There is an abundance of literature covering ICT adoption and performance, but does not focus on the adoption of ICT usage and the corresponding perceived impact on performance specifically within SME manufacturing sector in South Africa (Zuppo, 2012; Ritchie & Brindley, 2005; Wolf, 2001; Parker & Castleman, 2007). It is hoped that the research will provide insight into ICT adoption and how this either positively or negatively improves performance. The study should be able to demonstrate that ICT adoption may or may not act as positive reinforcement of performance.

The research will provide insight for existing and emerging entrepreneurs who are in manufacturing or have plans to start a manufacturing venture on the use of ICT and the perceived impact on performance. Furthermore it is anticipated that current and future SME manufacturers can gain insight into the benefits of adopting the various ICT levels in the manufacturing process.

1.5 Delimitations of the study

The research will only focus on SMEs in the manufacturing sector in South Africa and hence will exclude SMEs operating in other industry verticals. Furthermore the research will exclude SMEs that already operate within a manufacturing capacity that is within the electronics industry, for example software development, hardware development etc. The research will also exclude micro enterprises and survivalist enterprises as defined in Section 1 of the National Small Business Act of 1996 as amended by the National Small Business Amendment Acts (NSB) of 2003 and 2004 (Mahembe, 2011) and hence limit the study to SME, i.e. small medium enterprises. The NSB further defines SME by the number of employees and annual turnover. For purposes of this discussion an SME is an enterprise that has the following elements (Mahembe, 2011):

Enterprise Size	Number of Employees	Annual Turnover
Medium	Fewer than 100 to 200, depending on Industry	Less than R4 million to R50 m depending upon Industry
Small	Fewer than 50	Less than R2m to R25 m depending on Industry

1.6 Definition of terms

This section will define the major concepts and constructs that will be discussed and measured in the research, primarily SME, ICT, performance.

Small Medium Enterprise (SME):

As mentioned previously the definition that will be adopted in this research is based on the definitions as per defined by the National Small Business Act of 1996 as amended by the National Small Business Amendment Acts (NSB) of 2003 and 2004. (Mahembe, 2011), with specific attention to only small medium enterprises with the following scope:

Enterprise Size	Number of Employees	Annual Turnover
Medium	Fewer than 100 to 200, depending on Industry	Less than R4 m to R50 m depending upon Industry
Small	Fewer than 50	Less than R2m to R25 m, depending on Industry

Information Communication Technology:

There is no globally accepted definition of ICT. The definitions can either be extremely broad or meticulously descriptive. However there seems to be some commonality that emanates within the various interpretations. The purpose of this section is hopefully to provide a holistic definition that encompasses the various compositions of the term ICT. A deeper analysis of the construct will be explained in Chapter 2. Hence the definition that will be adopted for this research of ICT will be:

ICT is the use of technologies that facilitate the processing, transferring and communicating of information in a digital manner. ICT also encompasses how the technology is used i.e. for general, productive of advanced usage. ICT also encompasses if it is utilised as a support administrative function (Zuppo, 2012; Modimogale & Kroeze, 2011; Modimogale & Kroeze, 2009; Pierson et al., 2009).

Performance:

Most business enterprises are in existence not only to offer a service for a particular market but to ensure that the execution of that service is done profitably and efficiently. In other words a business enterprise should strive to achieve maximum output with the most efficient use of input resources to obtain maximum profit. “From an accounting point of view, profit is excess income earned over the expenses incurred to produce that income. “ (Dempsey & Pieter, 2002; p.79) . ICT’s role in improving business performance is seen as providing the efficiency and effectiveness to maximise the efficient use of resources to gain maximum profitably. This could involve increasing productivity output, improving sales, better customer engagement, increasing market share, etc., hence improving profitability and organisational competitiveness.

1.7 Assumptions

It was assumed that all respondents in the research have an idea of ICT usage and have interacted with ICT at some level, i.e. general, productive and advanced. The importance of this is that the respondents will complete the survey with some contextual understanding of what ICT can deliver and its perceived impact on performance.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

The literature review will cover content that relates to the main constructs i.e. *What is ICT? Factors leading to ICT adoption by SMEs, and how usage of ICT seemingly impacts performance*, followed by a discussion on the sub-problems and the related research question and supporting hypotheses respectively.

2.2. Background discussion.

What is ICT?

The "primary definition of information and communication technologies centers around the devices and infrastructures that facilitate the transfer of information through digital means." (Zuppo, 2012; p.13). ICT can also mean different things depending on the context that it is used. Zuppo (2012) highlights the four contexts.

ICT within an *economic development* context refers to access to mobile infrastructure and the associated devices that allow for the exchange of information. ICT within an *economic sector* context refers to the ICT manufacturing of goods and services and related services. ICT within an *education context* refers to the use of devices or related equipment in building competency to engage with the technology. ICT within a *business/IT context* refers to infrastructure and devices that facilitate the processing of information and enhancing communications. Despite the differences in definition depending on the context, there is still a common thread that which resonates in ICT technologies, namely ICT technologies "facilitate the transfer of information and various types of electronically mediated communication." (Zuppo, 2012; p.19).

Other definitions of ICT emphasis the levels or categories of ICT i.e. ICT used as an administrative and support tool and ICT used in the production process of goods and services. (Modimogale & Kroeze, 2009). Similarly Pierson et al. make a distinction between primary ICT and secondary ICT. Primary ICT relates to the automation of the production process while secondary ICT relates to the use of ICT as a support administrative function such as e-mail, internet and CRM, accounting systems etc. (Pierson et al., 2009).

Similarly Ismail, Jeffery & Belle (2011) distinguish between three types of ICT usage i.e.:

a. ***General ICT usage*** i.e. Internet access, Email, bulk SMS, VoIP, organisational website and intranet (Ismail et al., 2011).
b. ***Production – Orientated usage*** i.e. Accounting, Production, Inventory, Human Resource, Enterprise Planning systems, Customer Relationship Management (CRM) and Supply Chain (SCM) packages/systems (Ismail et al., 2011).
c. ***Advanced ICT usage technology*** i.e. Software as a Service, Content Management, Mobile CRM, Mobile payment systems and systems virtualisation

The findings from Ismail et al, (2011) suggest that the adoption of ICT services does add value. Their findings suggest that general ICT usage is the most adopted form of ICT followed by production orientated and advanced. The most notable benefit for adoption sited in their report was the "organisation has turned out to be more marketable and they have been able to increase their customer base as a result." (Ismail et al., 2011; p.9). Furthermore the authors also discovered that some SME owners did not perceive the adoption of ICT adoption as adding significant value. This is based on the premise that a substantial amount of capital has been invested and that the return on investment has not been immediate.

The various definitions seem to converge in terms of the central principles that seem to be common in defining ICT i.e. ICT is the exchange of information in a

digital manner. ICT can either be utilised as a support function or as part of the production process.

Hence the definition that will be adopted for this research of ICT will be:

ICT is the use of technologies that facilitate the processing, transferring and communicating of information in a digital manner. ICT also encompasses how the technology is used i.e. for general, productive of advanced usage. ICT also encompasses if it is utilised as a support administrative function (Zuppo, 2012; Modimogale & Kroeze, 2011; Modimogale & Kroeze, 2009; Pierson et al., 2009)

Research pertaining to the relationship of ICT and SMEs is characterised by three research perspectives, namely; 1) Technological perspective i.e. examines how ICT is being utilised within SMEs and how successful the ICT service is as opposed to how successful the business is (Southern & Tilley, 2000). The second research perspective known either as 2) the Management or Organisational perspective, is premised on the view to "understand the small firms strategic approach to using IT and the capabilities and structures of the small firm to use the technology" (Southern & Tilley, 2000; p.141). The final research perspective 3) SME perspective i.e. attempts to provide insight into ICT adoption from the SME owner -manager point of view. Adoption of ICT within SMEs is perceived as valuable if it forms part of the business activity (Southern & Tilley, 2000).

All three perspectives should add depth to understanding why SMEs adopt ICT services, by providing researchers insight into how successful the technology is within the business, gain insight into how capable the SME organisation is in utilising the technology and finally how valuable the owner-manager perceives

the investment of ICT i.e. can they realise a return on investment. (Southern & Tilley, 2000)

Adoption of ICT in SMEs

The adoption of ICT within SMEs has been linked with the improved performance. The adoption of ICT has been shown to provide organisations a competitive edge by increasing efficiencies and productivity and also “improving efficiency in resource allocation, reducing transaction costs, and technical improvement, leading to the outward shifting of the production function.” (Wolf, 2001; p.2). Hence the generally accepted view is that a country that has a sustainable telecommunications infrastructure, acts as an enabler for ICT adoption by SMEs who may see positive benefits for adopting ICT services.

The decision to adopt ICT services is influenced by various factors, i.e. the entrepreneur’s appetite to use technology, the market conditions that the SME operates in and the adoption of similar ICT services by other SMEs in the same industry. This point is reinforced by Müller-Falcke (2001) in Wolf (2001) based on a study of SMEs in India where the author found that ICT adoption followed a S-curve, i.e. small numbers of SMEs that adopted an innovation in the initial stages and hence the diffusion of the ICT innovation was small, but as other SMEs observed the gradual uptake of the innovation there was a speedy diffusion of the technology as the SMEs enjoy the benefits of the innovation. The next phase is when there are a large proportion of adopters of the innovation; there is a noticeable decrease in the diffusion of the technology (Wolf, 2001).

Other scholars explicitly argue that in the new economy, i.e. knowledge economy, any business enterprise that has the ambition to be market leading

and competitive simply has no option but to integrate ICT as part of its competitive advantage. This principle also applies to SMEs (Barba-Sanchez, Martinez-Ruis, Jimenez-Zarco, 2007) . Furthermore Barba-Sanchez et al (2007) also argue that the adoption of ICT services by SMEs is based primarily on the individual entrepreneur's appetite to technology, the ability for the SME organisation to adopt a learning culture whereby knowledge is produced to create new ways of servicing customer needs and requirements. The latter is also referred to as the innovation orientation (Barba-;Sanchez et al., 2007). Hence the innovation orientation of the firm will determine which ICT services are adopted that will make the SME competitive.

Benefits associated with ICT adoption include but are not limited to 1) increased productivity and effectiveness , for example automation of processes for the sales staff in the field; 2) provide access to information which is critical with regards to making decisions about customers, competitor , for example information obtained about customers allows for targeted marketing initiatives; and 3) Increase collaboration and knowledge transfer within the organisation and its stakeholders (Barba-Sanchez et al., 2007). Furthermore the successful adoption and implementation of ICT within an SME is also dependent on the SMEs culture on using technology as well as the skills levels within the organisation to gain maximum output. ICT alone does not provide the SME competitive advantage, "ICT must be complementarily exploited along with other business resources in order to get a source of competitive advantage" (Barba-Sanchez et al, 2007; p.111).

In their findings on work done on SMEs in Oman, Ashrafi and Murtaza (2008) highlight that SMEs in that region are starting to set aside budgets as part of ICT investment. Despite the overall investment in ICT being relatively low, there are certain drivers that act as catalysts towards ICT investment which are improved customer service experience and staying ahead of the competition (Ashrafi, Murtaza, 2008). Furthermore ICT investment was found to be a

catalyst to increasing market share, increasing sales and reducing the SMEs cost base (Ashrafi, Murtaza, 2008). It was also found that ICT investments by SMEs in Oman was linked to long term aspirations of improving product and service quality (Ashrafi, Murtaza, 2008; p.132).

Conversely there are scholars who have demonstrated that the adoption of ICT within SMEs has not produced the expected adoption rates. There are barriers that inhibit the adoption of ICT services by SMEs. These barriers include but are not limited to the SMEs readiness to adopt new technology which could encompass the complexity of the technology and the lack of skill within the SME organisation to understand and implement the technology which may prolong the adoption of ICT services by SMEs (Ritchie & Brindley, 2005) . Barriers to ICT adoption may also be linked to the organisation's lack of commitment to life time learning i.e. learning new technologies and finding out how these are applicable within their respective organisations. Also critical is the readiness of the employees to commit to a journey of continued learning as and when new technologies are made available.

Perceived high set up costs are also identified as barriers to ICT adoption. This view is supported by "ICT solutions are generally associated with millions of rands and stories of ICT solutions are synonymous with running over budget" (Modimogale & Kroeze, 2011; p.4). ICT adoption is associated with exorbitant capital outlays which become a deterrent for entrepreneurs to adopt the technology. The cost of ICT services, especially in developing countries, is a hindrance to adoption. In South Africa the high costs of connectivity "coupled with a lack in infrastructure which supports emerging technologies."(Ismail et al., 2001; p.4), has been observed as a factor that also hinders ICT technology adoption.

Furthermore Ritchie & Brindley (2005) argue that the personal contacts of the entrepreneur and the business networks of the firm itself also influence the adoption rate of ICT within the SME. If there is enough knowledge transfer, support, etc. within the firm network about how to implement and use the new technology, then this will impact positively on the rate of adoption. Intrinsic in this process is an element of trust i.e. if the information provided by the respective network is deemed untrustworthy and the entrepreneur does not trust the technology supplier, then the adoption rate will be low. Conversely the same principle would apply.

Performance

The previous discussion centred on the theory that supports the usage of ICT within the SME sector. It also looked at the theory that explained the slow adoption of ICT. The following discussion will specifically focus on the performance variable that is linked with ICT adoption i.e. does ICT adoption lead to greater performance for an SME or not. The discussion will also look at various performance indicators that are linked to ICT adoption, namely productivity, increased market share, increased product and service innovation.

In their article Modimogale & Kroeze (2011) based on the role of ICT within SMEs in Gauteng, the authors site the work of Schubert & Leimstoll (2007) which examines the value of ICT within an SME. Schubert & Leimstoll (2011) present two perspectives on ICT value. The one school of thought known as Porters theories argues that the ICT does add value to SMEs while the other school of thought known as Millar's theory states that ICT does not add value to SMEs because ICT is simply a commodity product that cannot be differentiated (Modimogale & Kroeze, 2011).

The competing schools of thought do have a common stance in that they agree that the simple adoption of ICT within the SME does not automatically give the SME competitive advantage; competitive advantage is achieved only if the adoption of ICT formed part of the SMEs strategic objectives and that the adoption of ICT services is linked to business process. In light of the current discussion, if an SME incorporates ICT adoption as part of its strategy and links ICT to the organisations business processes, then this will provide the SME with a competitive advantage which one can assume would improve its performance. (Modimogale & Kroeze, 2011).

A similar view is supported by work done in the 1990s on manufacturing sector in Canada that examined the relationship between firm performance and the use of advanced technologies (Computer Aided Designs (CAD), local areas networks and engineering equipment, etc.) in the manufacturing sector(Baldwin & Sabourin, 2002)

Of particular relevance to this study is the role of ICT on the production process. The authors (Baldwin & Sabourin, 2002) conclude by establishing a positive relationship between the adoption of advanced ICT products/services (software, network communication and hardware(robots)), and the manufacturers' improvement in productivity, market share, growth, etc. It is the introduction of "soft-manufacturing", i.e. combination of software, computer networks and hardware that has enhanced the ability of manufactures to be efficient, innovative and growth orientated(Baldwin & Sabourin, 2002).

This view is further supported by Dalota & Grigore (2010) who emphasize that SMEs can only survive if they are innovative. Innovation could also extend to the use of ICT to improve business processes and provide the SME the platform to compete globally, hence expanding the market base. A combination of advanced manufacturing technologies together with the adoption of ICT

services and the creation of new services allows SMEs to be competitive and potentially grow their market share.

Unfortunately the study is limited to the Canadian manufacturing sector; secondly there is no distinction on how these findings relate to SMEs. However it is hoped that the same principles will be similar within the South African context of SMEs in the manufacturing sector.

Bigliardi (2013) in a recent study that looks at the impact of innovation and SME financial performance concludes by stating that “Conversely, results show that financial performance of companies is not impacted by the level of technology adopted in developing innovation.” (Bigliardi, 2013; p. 252). In other words, the level of ICT adoption does not impact how innovative an SME will be. By simply adopting technology, there is not a causal relationship that the firm will be innovation.

Commercial success with the adoption of ICT services by an SME is based on certain success factors that have been identified by Taylor & Murphy (2004) as:

- “owner motivation, experience and management skills;
- expertise in managing growth;
- access to resources (money, technology and people);
- innovation, a competitive advantage and flexibility;
- close contact with customers;
- a focus on profits rather than sales; and
- strong demand and operating in a growth market”

(Taylor& Murphy, 2004; p. 289)

In essence the entrepreneur has to be motivated and excited about adopting technology that could provide the firm some level of differentiation. The entrepreneur also has to have high human capital in terms of experience in managing organisations and the network to access resources that are required to enhance the business operation, coupled with adopting innovation that will enhance competitive advantage for the firm. Finally, the entrepreneur should focus on profits rather than sales and should concentrate on growing market share.

The success factors are further underpinned by the following elements which need to be adopted by the SME; these are:

- “They need to have a clear ICT strategy that will govern the adoption process with that particular SME.
- They need to make sure the ICT strategy is aligned with the business strategy, which means that the ICT strategy should support and achieve business goals.
- The SME should make sure that it employs the right skills (permanent or contracted) and identifies the roles that these skills will play in making sure that the SME is successful in leveraging ICT.”
  (Modimogale & Kroeze, 2011; p.6)

The insight provided is useful in providing the critical success factors and the foundations that need to be in place to achieve commercial success. It is suggested that the entrepreneur establish an ICT strategy that will enable and support the business strategy.

The literature also discusses the “productivity paradox” associated with the adoption of ICT by enterprises. It should be noted that this productivity paradox was established within a context during the 1970s and 1980s where studies during this period “showed negative or zero impacts of investment in ICT on productivity…Many of these early studies focused on labour productivity, which made the findings surprising as investment in ICT adds to the productive capital stock and should thus, in principle, contribute to labour productivity growth”(Pilat, 2004; p.43).

It is argued that this paradox existed because ICT’s impact on productivity was sometimes not measured in productivity statistics, for example the impact of Automated Teller Machines (ATMs) on the financial services industry was not reported under productivity improvement but rather as improving the experience of banking. Another possible reason for the paradox was the benefits of the impact of ICT services took a while to be realised and hence the impact was not immediate. Furthermore early research could have sampled a small size of firms, hence the impact of ICT on performance may have been insignificant (Pilat, 2004)

It is fair to argue that technology that was adopted during the period under review did lack the sophistication and agility that is available today. A simple comparison of the ability to set up a website within minutes and have a public persona that potential customers are able to trade with you can happen within a matter of minutes, hence as a SME owner the impact and convenience ICT services can be appreciated almost instantaneously. Compared to when the productivity paradox studies were conducted, present day studies are able to demonstrate how ICT has impacted positively on productivity (Pilat, 2004).

Improvements in firm performance were also dependent on factors such as the level of skills available within the firm to utilise the adopted ICT technology. It

was also found that firms that were using advanced ICT technology who also invested in training and up skilling their staff were “associated with higher productivity growth” (Pilat, 2004; p.50).

Performance may also incorporate the following elements which include but not limited to increasing market share/growth; improvements in products/service innovation. These additional performance measures are meant to supplement the traditional financial performance measures (Chan, Huff, Barclay, & Copeland, 1997). These measurement elements have also been proven to have shown “reasonably strong reliability and validity” .(Marchand, Kettinger, Rollins, 2001; p. 145)

Furthermore, work done by (Raymond, Bergeron, & Blili, 2005) also reinforces that the adoption of ICT especially e-business by SME manufacturers in Canada has led to these organisations improving both their sales and export performance. It is fair to argue that this improvement in productivity has a correlating effect on financial performance. In their work on SMEs and ICT adoption in Nigeria, Uwalomwa & Ranti (2009) state that “ICT adoption in SME growth is correlated with the bottom line of company balance sheet. Firms using e-mail for customer communication, for instance, can grow about 3.4 % faster in terms of sales than those which do not” (Uwalomwa & Rati, 2009; p.4).

Research that has been conducted in this sphere has predominately been Eurocentric in approach. Limited studies exist especially on the adoption ICT within a South African context with specific reference to the manufacturing sectors. Moodley (2003) in his work on the effects of business to business commerce in the manufacturing industry provides a historical view of the manufacturing sector in South Africa pre 1994 that was protected by government due to “trade isolation, disinvestment and the imposition of economic sanctions during the 1980s and early 1990s. As a result, domestic producers were for a long time insulated from international competition”(Moodley, 2003; p.28).

The South African manufacturing industry faced a different set of challenges post 1994, which included government policy that encouraged open market trading and globalisation, coupled with the global transition to knowledge based economies where information and the ability to derive value from information are becoming the new forms of transacting and exchanging value. The adoption of B2B e-commerce in the South African manufacturing industry has been very slow and the full potential of e-commerce has not been exploited due to a number of reasons including but not limited to:

- Lack of appreciation of the benefits associated with e-commerce
- Perceived high costs of implementing e-commerce
- High cost of broadband connectivity

The adoption of B2B e-commerce capability is important for SA manufacturing firms to compete in the global market (Moodley, 2003).

The South Africa SME manufacturing industry has seen a decline in turnover growth since 1998 which is a result of declining product market share which is linked to an increasing penetration of import substitution goods into the local market. Another factor sited by SME owners in South Africa is the inflexible Labour Laws that make it difficult for the firms to be agile(Kesper,2000) , The adoption of ICT services as a catalyst to providing local manufacturers becoming globally competitive receives little attention within a South African context.

Dhungana (2003) explores the ICT adoption, performance and market share within a globalisation context by stating that globalisation has reduced the world by shrinking the world's economies by eliminating physical boundaries of doing business. "Globalisation has also resulted in the integration of economies and has prompted a rapid increase in the movement of products, capital and labour across borders" (Dhungana, 2003; p.1). This has created opportunities for SMEs to compete on a global scale by becoming part of the global value chain as the production process is being split amongst regions that are able to demonstrate efficiencies in resource allocation and utilisation. Furthermore the advent and adoption of ICT services has also accelerated the globalisation process making it possible for SME to compete beyond their natural borders (Dhungana, 2003).

2.3. Measure the adoption of ICT usage and the perceived impact on performance within the SME manufacturing sector in South Africa

The literature review has provided detailed insight into the constructs that form the research problem, i.e. what is ICT, why SMEs adopt ICT services and ICT linked with performance. In all the discussions of the constructs there have been various insights into each construct highlighting the complexity of each construct. The research seeks to uncover the adoption of ICT by SMEs within the manufacturing sector in South Africa. The literature review has provided a foundation to understand and operationalise the constructs, the discussion to follow will attempt to uncover whether the adoption of ICT by SMEs within the manufacturing sector in fact leads to increased productivity, market share, etc., as stated in most of the theory.

2.3.1 Measure the adoption of ICT usage within the SME manufacturing sector in South Africa

The decision to adopt ICT services is influenced by various factors i.e. the entrepreneur's appetite to use technology, the market conditions that the SME operates in and the adoption of similar ICT services by other SMEs in the same industry. Furthermore the level of ICT adoption, i.e. ICT used as an administrative and support tool and ICT used in the production process of goods and services (Modimogale & Kroeze, 2009). Coupled with the perceived value gained from ICT adoption, this point is illustrated by Modimogale & Kroeze (2011) when they state that SMEs will adopt ICT services if ICT adoption forms part of the organisation strategy and that the adoption of ICT is linked to a business process. Moodley (2003) and Kesper (2000) provide valuable insight into the state of the South African Manufacturing industry i.e. adoption of e-commerce and declining turnover growth respectively. Manufacturing sectors contribution to real GDP in the first quarter of 2013 showed a negative contribution (-1, 2%) (StatSA, 2013).

2.3.2 Research Question

The literature review has thus set the scene for the research to start uncovering why SMEs in the manufacturing sector in South Africa would consider adopting ICT. It is from this enquiry that the research poses the following research question:

What is the ICT adoption rate by SMEs in the manufacturing sector in South Africa?

2.3.3 Evaluate the perceived impact of ICT adoption on performance within SME manufacturing sector in South Africa.

ICT's role in improving business performance is seen as providing the efficiency and effectiveness to maximise the use of resources to gain the maximum profitably. This could involve increasing productivity output, improving sales, better customer engagement, etc., hence improving profitability and organisational competitiveness.

Commercial success with the adoption of ICT services by an SME is based on certain success factors that have been identified by Taylor & Murphy (2004) as:

- "owner motivation, experience and management skills;
- expertise in managing growth;
- access to resources (money, technology and people);
- innovation, a competitive advantage and flexibility;
- close contact with customers;
- a focus on profits rather than sales; and
- strong demand and operating in a growth market."

(Taylor& Murphy, 2004; p. 289)

Improvements in firm performance are also dependent on factors such as the level of skills available within the firm to utilise the adopted ICT technology. It was also found that firms that were using advanced ICT technology who also invested in training and up skilling their staff were "associated with higher productivity growth" (Pilat, 2004; p.50).

It is with the integration of the specific contructs, and the supporting literature review that four hypotheses are presented that will be tested during the research. These are:

Hypothesis 1

There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

Hypothesis 2

There is a positive monotonic relation between perceptions of ICT adoption and increased market share within SMEs in the manufacturing sector in South Africa.

Hypothesis 3

There is a positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

Hypothesis 4

Entrepreneurs who have higher ICT adoption levels ***perceive*** *a greater impact of ICT levels on performance than those with lower ICT adoption levels.*

2.4. Conclusion of Literature Review

The literature review has demonstrated that there is no uniform accepted definition of ICT and that the term is used in various contexts which imply it takes on different meanings within a specific context. However, the literature review has also established certain commonalities in the definition of the construct namely that ICT technologies "facilitate the transfer of information and various types of electronically mediated communication." (Zuppo, 2012; p.19).

ICT also encompasses distinct levels or categories. The first category or level distinguishes ICT in relation to its application as an administrative and support tool and the second level of categorisation distinguishes ICT as being utilised in the production process of goods and services. Other authors distinguish between ICT usage and introduce three levels of usage namely; general, production and advanced.

Furthermore the adoption of ICT by SMEs is influenced by various factors i.e. the entrepreneur's appetite to use technology, the market conditions that the SME operates in. The adoption of ICT by SMEs is argued to be linked to increased firm performance provided that the adoption of ICT forms part of the organisations strategic objectives and that these objectives support the business objectives of the SME (JOFFE, 1995; Moodley, 2003; StatsSA, 2013). Furthermore the adoption of ICT by SMEs may be a catalyst to increase market share for the SME because the SME is no longer limited to trading in a specific geography but may trade globally. Furthermore SMEs that utilise ICT are prone to offer innovative products and services.

It is within this context that the following hypotheses were devised that state:

Hypothesis 1

There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

Hypothesis 2

There is a positive monotonic relation between perceptions of ICT level adoption and increasing market share within SMEs in the manufacturing sector in South Africa.

Hypothesis 3

There is a positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

Hypothesis 4

Entrepreneurs who have higher ICT adoption levels ***perceive*** *a greater impact of ICT levels on performance than those with lower ICT adoption levels.*

CHAPTER 3: RESEARCH METHODOLOGY

The purpose of this section is to provide a structure on how data will be collected, measured and analysed. In essence this section will cover the research design. (Cooper & Schindler, 2011). The method of the data collection was done via an online survey and paper based questionnaire. The latter involved visiting the respondents at their respective business locations.

The time element of the study was a cross – sectional study i.e. the study was "carried out once and represent a snapshot of one point in time" (Cooper & Schindler, 2011; p.142). As such the study does not seek to establish a causal relation between ICT adoption and firm performance.

Due to time constraints relating to the gathering of data, the study could not be a longitudinal study hence a cross-sectional study. This is not to imply that the longitudinal study is the better option. Furthermore, this will be a statistical study where the stated hypotheses will be tested from a sample of respondents whose characteristics are representative of the SME manufacturers in South Africa, hence allowing the study to make qualified generalisations (Cooper & Schindler, 2011). The research will be correlational study which will aim to seek a relationship between ICT level adoption and the perceived impact on performance.

Measure the adoption of ICT usage within the SME manufacturing sector in South Africa

The decision to adopt ICT services is influenced by various factors i.e. the entrepreneur's appetite to use technology, the market conditions that the SME operates in, whether ICT is seen a strategic objective in enabling and achieving the organisational goals of the SME. The research conducted should be able to provide insight into why SMEs in the manufacturing sector opt to adopt or not to adopt ICT services and whether ICT is deemed as a strategic objective to achieving business objectives. The research will be able to provide insight into the sub-problem.

The research scales used were able to measure ICT usage and the perceived impact on firm performance. Performance as a construct was not measured directly; instead the study measured the perceptions of ICT adoption and the impact on firm performance.

Evaluate the perceived impact of ICT adoption on performance within the SME manufacturing sector in South Africa

ICT's role in improving business performance is seen as providing the efficiency and effectiveness to maximise the efficient use of resources to gain the maximum output and increase profitably. This could involve increasing productivity output, improving sales, improving customer engagement, increasing market share etc., and hence improving profitability and organisational competitiveness. Improvements in firm performance are also dependent on factors such as the level of skills available within the firm to utilise the adopted ICT technology. It was also found that firms that were using advanced ICT technology who also invested in training and up skilling their staff were "associated with higher productivity growth" (Pilat, 2004; p.50).The research scales administered were guided by the prevailing literature. Four of the scales administered

measured perceived impact (performance) as a result of ICT adoption. These consisted of the following scales: a) performance, b) market share, c) product/service innovation and d) perceived higher ICT levels have a greater impact on firm performance.

3.1 Research methodology /paradigm

The research methodology adopted was a quantitative approach also using descriptive and correlational statistics (Spearman Correlation) and graphics to summarise the results and interpret accordingly. Factor analysis could not be conducted due to not having enough data, hence a simplistic analysis was adopted. A positivist paradigm guided the research process. In order to establish the truth only scientific methods can be adopted which are deemed objective. “Positivism is based upon the view that science is the only foundation for true knowledge” (Wagner, Kawulics & Garner, 2012: p.53). Furthermore, within the positivism paradigm, the function of a research study is its ability to “predict results, test theory or find the strength of relationships between variables…” (Wagner, Kawulics & Garner, 2012: p.55).

The reason for this approach was primarily to test the theory that is associated with why SMEs adopt ICT and how this impacts on perceived performance. The purpose of adopting a quantitative approach was also to explore if the theory presented could be predictive and finally this approach was adopted because the data analysis is clinical because it is statistical in nature and leaves no room for bias (Cooper & Schindler, 2011). This was important to this research as there was a “clear distinction between facts and judgements” (Cooper and Schindler, 2011; p.163).

In relation to the research, the research needs to understand why SMEs in the manufacturing sector adopt ICT , and if the latter is correct what impact on perceived performance can be measured as a result of adoption.

Common Method Biases

It is acknowledged that the research may be influenced by common method bias i.e. “variance that is attributable to the measurement method rather than to the constructs the measures represent” (Podsakoff, Mackenzie & Lee, 2003; p.879). The impact of common method biases is that it may impact the conclusions of the study by providing measurement error (Podsakoff et al., 2003) . Measurement error may either be random or systematic. The latter is argued to be contentious because of its ability to provide “alternative explanation for the observed relationships between measures of different constructs that is independent of the one hypothesised”(Podsakoff et al., 2003; p.879). This may lead to incorrect results/ findings about the study (Philip M. Podsakoff et al., 2003).

One of the scales in the instrument, namely “Perceived value of ICT adoption” consists of items that may be interpreted to suggest that ICT adoption does indeed have a perceived positive impact on performance. This is because each item does not ask a question but simply makes a statement, hence “variance that is attributable to the measurement method rather than to the constructs the measures represent” (Podsakoff, Mackenzie & Lee, 2003; p.879).

3.2 Research Design

The methodological approach that was initially adopted was an on-line survey. The reason for this was to start measuring if the respondents have access to ICT services to participate. One of the objectives in the research was to measure adoption levels of ICT usage. The on-line survey responses from the respondents were extremely poor, with only 8 responses from the online survey. An alternative approach was engaged where respondents were provided with paper questionnaires to complete. This resulted with 120 completed surveys.

The purpose of the study will be a correlational study which aims to establish if the adoption of ICT levels within an SME in the manufacturing sector in South Africa will have a perceived positive effect on firm performance (Cooper & Schindler, 2011).

Advantages of an on-line survey:

- No involvement required from the researcher to administer the survey, hence eliminating the bias aspect of contact with the researcher.
- No involvement in preparing the respondents hence avoiding participants perceptual awareness which may influence the outcome of the research (although the introductory letter can still create perceptual awareness).

Disadvantages of on-line survey:

- Due to the survey being quantitative, it requires that the sample size be large which may impact on the turnaround times of collecting the data.
- Not all respondents may have access to ICT facilities that will enable them to respond.
- Difficult to build credibility with respondents so that they complete the survey, due to the non-physical nature of collecting data.

Advantages of paper questionnaire:

- Allows researcher to build face to face credibility with the respondents so that the survey may be completed.
- Collection of data is speedier as the researcher has direct contact with the respondent, hence can influence the completion of the survey.
- Researcher may clarify questions immediately hence limiting the omission of questions not completed due to respondents lack of understanding.

Disadvantages of paper questionnaire:

- Due to researcher involvement in completion of the survey, the researcher may indirectly influence how the respondent completes the survey, hence there being bias due to contact with the respondent.

3.3 Population and sample

3.3.1 Population

The SME manufacturing industry is not a homogenous industry in South Africa. For the purposes of this research, data was collected from SME manufactures that are perceived not to be prone to high ICT utilisation and that are both administrative/supportive and linked to business processes in nature. I have deliberately excluded manufactures that are prone to high ICT utilisation , for example manufactures in the computer and electronic sphere, manufactures of electrical equipment, appliances etc. (www.southafrica.smetoolkit.org, 2013)

Furthermore there was careful attention paid to ensure that the respondents to the survey fell within the agreed definition of SME. The population identified enabled the research to make qualified inferences because of the total collection of elements, i.e. SMEs that operate within a sphere where there is perceived non utilisation of ICT (Cooper & Schindler, 2011).

3.3.2 Sample and sampling method

Sample

The reason to adopt sampling is that sampling in relation to this study will be cost effective. The sample can provide enough information to make inferences by collecting data from a few sample as opposed to collecting data from all SMEs in the manufacturing sector, furthermore there is greater accuracy of results from sampling (Cooper & Schindler, 2011).

Sample Method

The sample method adopted was the probability sampling method. This is because it is based on random selection – "a controlled procedure that assures that each population element is given a known nonzero chance of selection. This procedure is never haphazard. Only probability samples provide estimates of precision" (Cooper &Schindler, 2011; p.369). This means that the sample frame will be encompassing of population elements and will provide the opportunity to make generalisations based on the findings.

Stratified random sampling was used in the research because of the specific objective of understanding perceptions of how ICT adoption has a perceived impact on SME's in the ***manufacturing*** sector in South Africa. SME's in South Africa are not homogenous; hence stratified random sampling is "useful when the researcher wants to study the characteristics of a certain population subgroups" (Cooper & Schindler, 2011; p.379).

The sample frame consisted of 128 respondents. The respondents to the survey were chosen via a probability sample (stratified) that examined SMEs in manufacturing that do not to utilise high ICT. The majority of respondents (120) were chosen from two industrial hubs in Johannesburg i.e. Strydom Park in Randburg and Kya Sands in Northriding. The eight online responses were from a sample of SME's in manufacturing from a company SME database (Vodacom South Africa) which is proprietary information.

Furthermore each respondent that was chosen was in manufacturing and adhered to the definition of SME adopted in the study. All the respondents were provided an introductory letter explaining the purpose of my research and why their input is valuable.

It is also noted that if the response rates did not meet the expected minimum response rate then the sample would be deemed a non-probability convenience sample as the respondents will participate in the survey by choice i.e. self-selected (Cooper & Schindler, 2011).

3.4 The research instrument

The research method that was used to gather information was an on-line survey and paper questionnaires. The communication approach was an on-line survey that was self-administered by the respondents in the sample frame and a paper questionnaire that was administered by the researcher. The questions were deigned to test the research sub problems i.e. measure the adoption of ICT within the SME firm environment and evaluating the perceived impact of ICT adoption on firm performance. The instrument utilised a combination of mostly Likert type scale, yes/no responses and demographic questions.

Likert type scales are popular because they are easy and quick to create, provide the research designer the option to measure each item via a level of favourability or unfavourability. It is also argued that these scales are more reliable (Cooper &Schindler, 2011).

Measurement Validity

The objective of measurement validity criteria is to ensure that the research instrument used actually measures or tests what is intended to measure. Within the scope of the research at hand the instrument's validity would be to test if it actually measures the ICT adoption and SME performance.

Validity also includes ensuring that the measurement instrument covers content validity i.e. the sample frame is a true reflection of the population and that the matters of interest are adequately covered by the sample frame, then "content validity is good" (Cooper &Schindler, 2011; p.281). The scales were designed based on what is already in the literature and modifications to scales that already had been tested.

The sample frame was representative of the manufacturing sector and excluded SMEs in manufacturing that have a high propensity to use ICT, i.e. manufacturing of ICT products and services.

Internal Validity

The objective of Internal validity is to ensure that the research instrument used actually measures or tests what is intended to measure by the designer(Cooper &Schindler, 2011). “Does the instrument really measure what its designer claims it does?” Cooper &Schindler, 2011; p.281). Within the scope of the research at hand the instrument’s validity would be to test if it actually measures the perception ICT adoption and perceived impact on SME performance.

Measurement Reliability

According to Cooper and Schindler (2011), an instrument is reliable if it provides consistent results. There exists a relationship between reliability and validity. Validity is concerned with ensuring that what is required to be measured is actually measured, while reliability is concerned with the measuring outcome being consistent and not erratic. In relation to the context of the study the instrument should be able to provide consistent results that may be repeated, for example an SME that adopts ICT should demonstrate an improvement in firm performance and the converse is also true. The instrument should provide consistent results within the same context.

Scale Reliability

Scale reliability will be tested by administering Cronbach's Alpha. The latter "determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability"(Santos, 1999; p.1).

The research instrument has the following scales:

Demographics

This provides insight into the characteristics of the SME, i.e. number of employees employed, annual turnover, market share and designation of the respondent.

Measure of ICT level adoption

The scale has seven items which require a yes or no response. The objective of the scale is to measure the level of ICT usage in the organisation.

Measure adoption of ICT by SMEs

The scale is designed to measure how ICT is adopted by the SMEs. It has five items that measure adoption by examining the company strategy, capability as well as external influences which influence adoption. A Likert scale is used as a form of response scales.

Perceptions of Performance

The scale is designed to measure perceived performance as a result of ICT adoption, i.e. since adopting ICT there been a perceived positive increase in productivity, profitability, effectiveness and quality of products and services.

Market Share

The scale is designed to measure the perceived effect of ICT adoption and its effect on increasing an SME's market share.

Measure the product and service innovation

The scale is designed to measure the perceived effect of ICT adoption and the improvement in product and service innovation. The scale has 5 items.

Perceived Value of ICT Adoption

The scales seeks to measure the perceived significance of ICT level adoption within an SME ranging from increased customer satisfaction level to the creation of new innovative products and services.

Employee's Skills Level to utilise ICT levels

The scale seeks to measure the SME's culture to learning, skills level of employees to use ICT etc. The scale consists of 5 items.

3.5 Procedure for data collection

An on-line survey was constructed and posted on the Internet. Links to the on-line survey were sent to the targeted sample. The researcher also conducted paper based surveys due to the poor response rate of the on-line surveys.

It is stated by Cooper and Schindler (2011) that the respondents to a research study do “not suffer physical harm, discomfort, pain, embarrassment, or loss of privacy” (p32). To ensure that these do not occur, the researcher needs to clearly articulate the benefits of the study, what rights and protections the respondents have and finally gain consent from the respondents (Cooper & Schindler, 2011). Accordingly, in my explanatory letter I highlighted the benefits of the study; stipulated that the information gathered is strictly confidential and that the details of the respondents will not be disclosed to third parties. Furthermore, the participants had the right to privacy which entails they have the option to either participate in the survey or not (Cooper & Schindler, 2011).

3.6 Data analysis and interpretation

Once the data had been captured into the research instrument (on-line survey), it was downloaded for analysis. Once the paper questionnaires were completed in full, the responses were captured on an excel spreadsheet. Each scale was analysed by testing it via the descriptive statistics and frequencies and where appropriate correlational tests (Spearman) were administered. This is due to testing two continuous variables in each hypothesis. The tool utilised for this process was IBM SPSS Statistics 21.

The level of inquiry of the four hypotheses is based on correlations of two continuous variables for each hypothesis respectively:

Hypothesis 1

There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

- **Hypothesis 1: correlation between perceived ICT adoption and positive firm performance**.

Hypothesis 2

There is a positive monotonic relation between perceptions of ICT adoption and increasing market share within SMEs in the manufacturing sector in South Africa.

- **Hypothesis 2: correlation between perceived ICT adoption and increasing market share**

Hypothesis 3

There is a positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

- **Hypothesis 3: correlation between perceived ICT adoption and level of product and service innovation**

Hypothesis 4

*Entrepreneurs who have higher ICT adoption levels **perceive** a greater impact of ICT levels on performance than those with lower ICT adoption levels.*

- **Hypothesis: positive correlation between higher ICT level adoption and *perceived* greater impact on performance**

The statistical tests that were adopted to test the four hypotheses were mainly Spearman's Correlation Tests Coefficient. These tests "do not rely on the restrictive assumptions of parametric test. In particular, they do not use assume that the sampling distribution is normally distributed" (Field, 2013; p.880). The reason why this particular test was chosen is that ICT level adoption is an ordinal variable and not an equal interval variable.

3.7 Limitations of the study

- Sample frame not being adequate to cover the population.
- Limited access to e-mail addresses of the respondents in the sample frame to inform them about the study.
- Poor response on survey i.e. less than 120 respondents.
- The study is a cross-sectional analysis, i.e. snapshot of a point in time hence cannot provide longitudinal analysis as associated benefits.

3.8 Validity and reliability of research

In the context of the study, validity of the study refers to “the degree to which the study accurately answers the question it was intended to answer” (Gravetter & Forzano, 2012; p.167). Furthermore validity in this context also refers to the “quality of the research process and the accuracy of the results.” (Gravetter & Forzano, 2012; p.168). Reliability on the other hand is concerned with the research study providing consistent results within similar contexts. Hence there is a relationship between reliability and validity in any study, i.e. the research study should be able to provide input/answers on what it is meant to answer and that the results of the study can be consistently applied, leading to the generalisation of the study (Gravetter & Forzano, 2012; Cooper &Schindler, 2011).

In the context of the research it meant that research actually addressed or answered the research question and associated hypotheses. Furthermore that the research provides consistent results within similar situations/contexts.

3.8.1 External validity

External Validity refers to the ability of the research findings to be “generalised” across a specific population and how the findings are usable within that context. Cooper and Schindler (2011) define external validity as the “data’s ability to be generalised across persons, settings, and times …” (p.280). This definition is also supported by Gravetter and Forzano (2012) who also mention that the research study and associated results should be able to have general applicability “… and characteristics other than those used in that study” (p.168). It is anticipated that the research findings from this study will have external validity based on the sample frame that has been chosen for the study i.e. SME manufacturers that are thought to have an affiliation of adopting

ICT levels by the mere nature of the work they offer and vice versa. In essence the findings of the research study should be applicable to other studies of a similar nature.

3.8.2 Internal validity

The objective of internal validity is to ensure that the research study actually measures or tests what is intended to measure by the designer (Cooper & Schindler, 2011). Within the scope of the research at hand the validity of the research would be to test if it actually measures the ICT adoption and SME performance. This will be maximised by ensuring that the sample frame remains consistent.

3.8.3 Reliability

According to Cooper and Schindler (2011), a reliable research study provides consistent results. There exists a relationship between reliability and validity. Validity is concerned with ensuring that what is required to be measured is actually measured, while reliability is concerned with the measuring outcome being consistent and not erratic. In relation to the context of the study the research should be able to provide consistent results that may be repeated, for example an SME that adopts ICT levels should demonstrate an improvement in firm performance and the converse is also true.

CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

The following discussion will highlight the demographics of the sample and will be followed by the descriptive statistics, frequencies and correlational tests for each hypothesis where applicable, in line with the research question. The chapter will present the results from the tests done on the respective hypotheses and research question.

4.2 SME characteristics

The online survey was sent out to 1300 respondents with 8 successfully completed surveys. The paper questionnaire was completed by 120 respondents. Probability sampling (stratified) was used in order to draw qualified generalisations as the sample is representative of the population identified. The following demographic info was observed:

Table 1: Number of employees per SME

Employees

		Frequency	Percent	Valid Percent
Valid	Fewer or equal to 50	87	68	68
	Greater than 51 but fewer than 100	20	16	16

	Greater than 101 but fewer than 200	21	16	16
	Total	128	100	100

Table 2: Annual turnover of SME:

Annual Turnover

		Frequency	Percent	Valid Percent
Valid	Between R2m and R25	83	65	65
	Between R4m and R50	32	25	25
	N/A	13	10	10
	Total	128	100	100

Table 3: Percentage of market share of SME:

Market share

		Frequency	Percent	Valid Percent
Valid	0% to 2%	37	30	30
	>2% to 4%	30	23	23
	>4% to 8%	14	11	11
	>8% and above	47	36	36
	Total	128	100	100

Table 4: Roles of respondents:

Role in Firm

		Frequency	Percent	Valid Percent
Valid	Owner	63	49	49
	Manger	49	38	38
	Employee	16	13	13

	Total	128	100	100

The sample adhered to the definition of SMEs as defined in chapter one in relation to number of employees and annual turnover. The respondents to the survey were predominately owners of the SME followed by managers and small percentage employees. Some respondents were not comfortable providing the annual turnover figures, hence the N/A row.

4.3 Reliability of scales

Table 5: Scale: Adoption of ICT

Reliability Statistics

Cronbach's Alpha	N of Items
0.94	5

The reliability of the Adoption of ICT scale has a Cronbach's Alpha value of 0.94 which is above 0.80, hence the scale reliability is considered very good. There was no individual item that was higher than the total Alpha, hence all items were retained.

Table 6: Scale: Perceptions of Performance

Reliability Statistics

Cronbach's Alpha	N of Items
0.95	5

The reliability of the perceptions of performance scale has a Cronbach's Alpha value of 0.95 which is above 0.80, hence the scale reliability is considered very good. There was one individual item (*Doe Does your staff have the required skills to fully utilise ICT technology*? – Cronbach's Alpha of 0.96) that was marginally higher than the total Alpha, hence all items were retained.

Table 7: Scale: Market Share

Reliability Statistics

Cronbach's Alpha	N of Items
0.87	5

The reliability of the market share scale has a Cronbach's Alpha value of 0.87 which is above 0.80, hence the scale reliability is considered very good. There

was no individual item that was higher than the total Alpha, hence all items were retained.

Table 8: Scale: Perceptions of Product and service innovation

Reliability Statistics

Cronbach's Alpha	N of Items
0.94	3

The reliability of the perceptions of product and service innovation scale has a Cronbach's Alpha value of 0.94 which is above 0.80, hence the scale reliability is considered very good. There was one individual item (*The use of our products/services requires our customers to be ICT savvy – Cronbach's Alpha 0.94*) that was substantially higher than the original total Alpha of 0.86, hence that items was deleted.

Table 9: Scale: Perceived Value of ICT Adoption

Reliability Statistics

Cronbach's Alpha	N of Items
0.97	5

The reliability of the perceived value of ICT adoption scale has a Cronbach's Alpha value of 0.97 which is above 0.80, hence the scale reliability is considered very good. There was no individual item that was higher than the total Alpha, hence all items were retained.

Table 10: Scale: Employees skills to utilise ICT

Reliability Statistics

Cronbach's Alpha	N of Items
0.88	5

The reliability of the employees skills level to utilise ICT scale has a Cronbach's Alpha value of 0.88 which is above 0.80, hence the scale reliability is

considered very good. There was no individual item that was higher than the total Alpha, hence all items were retained.

4.4 Hypothesis 1

H1: There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

H0: There is no positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

Table 11: Scale: Descriptive statistics for ICT adoption by item

	Strongly agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %
Our organisation has a clear ICT strategy.	14%	21%	20%	20%	13%	8%	4%

Our organisation has skilled people who can work with different types of ICT levels.	27%	15%	20%	13%	13%	10%	2%
The organisational culture embraces new technology.	28%	20%	18%	12%	9%	10%	3%
ICT purchasing decisions are done in consultation with experts and/or feedback from the social/professional network.	28%	19%	19%	7%	6%	10%	11%
Our organisation budgets for ICT purchases	21%	12%	21%	13%	9%	18%	6%

- The table provides a description of how respondents, responded by each item for the ICT adoption scale.

Table 12: Descriptive statistics for Hypothesis 1

Descriptive Statistics					
	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Performance	128	3.05	1.73	0.59	0.21
Valid N (list-wise)	128				

- Mean and standard deviation respectively (*M=3.05, SD=1.73*). The *SD=1.73* is relatively highly compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean.
- The symmetrical distribution of the performance scale has skewness of 0.59 which means the distribution is fairly normal. A small SE 0.21 relative to the *M=3.05*

  "indicates that most sample means are similar to the population mean and so our sample is likely to be an accurate reflection of the population" (Field, 2013; p.55).

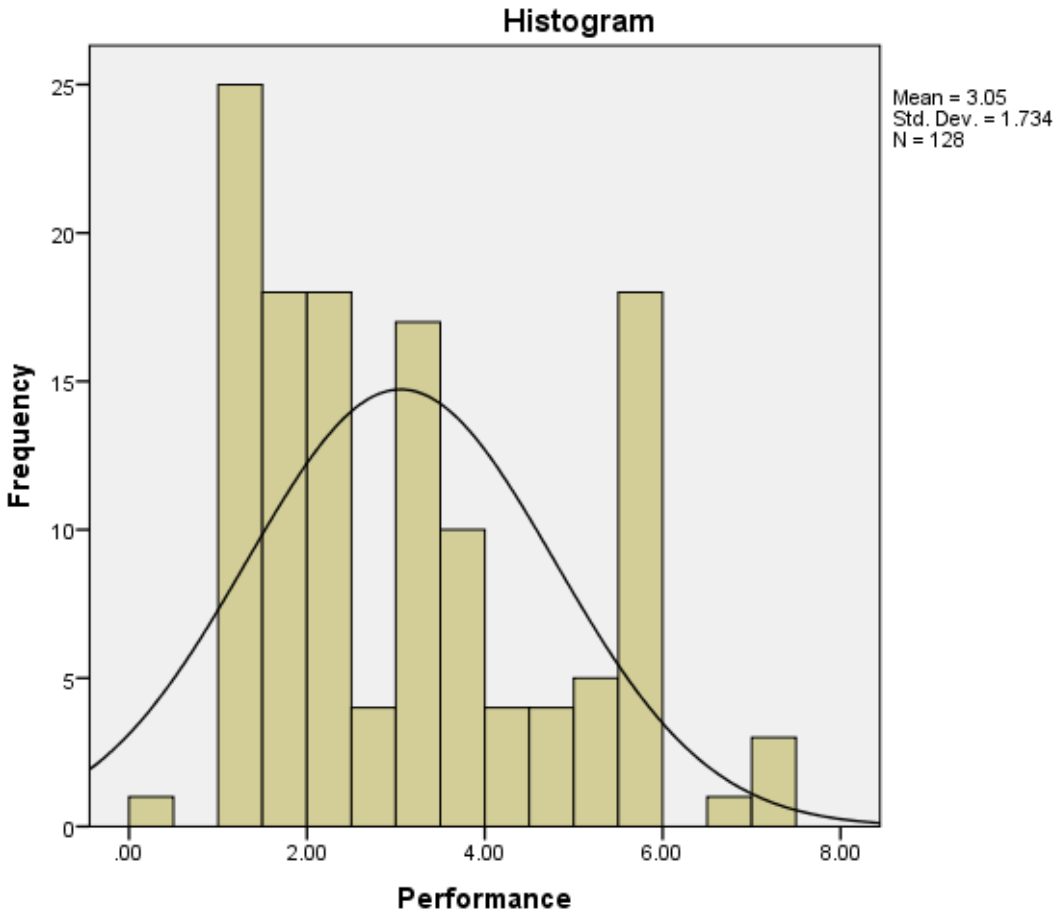

Figure 1: Histogram for Hypothesis 1

- The symmetrical distribution of the performance scale has skewness of 0.59 which means the distribution is fairly normal

Table 13: Spearman Correlation for Hypothesis 1

Correlations				
			Adoption of ICT	Performance
Spearman's rho	Adoption of ICT	Correlation Coefficient	1.00	0.81**
		Sig (2-tailed)	.	0.00
		N	128	128
	Performance	Correlation Coefficient	0.81**	1.00
		Sig (2-tailed)	0.00	.
		N	128	128
**. Correlation is significant at the 0.01 level (2-tailed).				

- Correlation Coefficient between the two variables is positively correlated via Spearman's Correlation r (128) = 0.81, p <. 001. The correlation coefficient has a small effect due to r (128) = 0.81, but $p < 0.05$ hence correlation is significant and the alternative hypothesis is adopted and the null hypothesis is rejected

4.5 Hypothesis 2

H1: There is a positive monotonic relation between perceptions of ICT adoption and increasing market share within SMEs in the manufacturing sector in South Africa.

H0: There is no positive monotonic relation between perceptions of ICT adoption and increasing market share within SMEs in the manufacturing sector in South Africa.

Table 14: Scale: Descriptive statistics for market share by item

	Strongly agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %
Has the adoption of ICT levels increased your market share locally?	17%	18%	22%	26%	6%	6%	5%
Has the adoption of ICT levels enabled your firm to trade globally?	20%	10%	16%	13%	6%	15%	20%

Has the adoption ICT levels differentiated your service from your competitors?	23%	12%	19%	16%	20%	4%	6%
Has the adoption of ICT levels enabled you to compete with Multinational Corporations?	23%	11%	12%	11%	17%	6%	20%
Has the adoption of ICT levels by your competitors given them competitive advantage?	20%	14%	15%	20%	14%	6%	11%

- The table provides a description of how respondents, responded by each item for the market share scale.

Table 15: Descriptive statistics for Hypothesis 2

Descriptive Statistics					
	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Market share	128	3.51	1.64	1.0	0.21

Valid N (list-wise)	128				

- Mean and standard deviation respectively (*M=3.51, SD=1.73*). The *SD=1.64* is relatively highly compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean.
- The symmetrical distribution of the performance scale has skewness of 1.0 which means the distribution is fairly normal and skewness is not substantial. A small SE 0.21 relative to the *M=3.51* "indicates that most sample means are similar to the population mean and so our sample is likely to be an accurate reflection of the population" (Field, 2013; p.55).

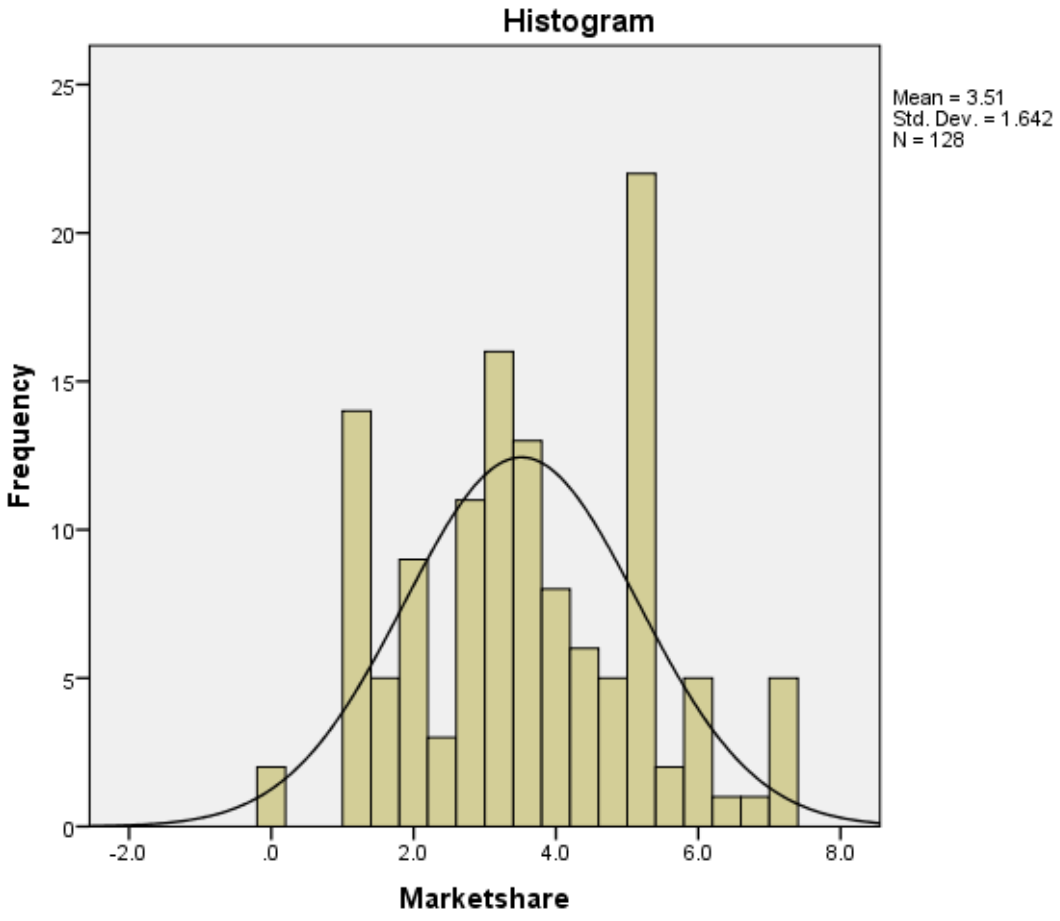

Figure 2: Histogram for Hypothesis 2

- The symmetrical distribution of the performance scale has skewness of 1.0 which means the distribution is fairly normal and skewness is not substantial (GraphPad Software, 2013).

Table 16: Spearman's Correlations for Hypothesis 2

Correlations				
			Adoption of ICT	Market share
Spearman's rho	Adoption of ICT	Correlation Coefficient	1.00	0.68**
		Sig (2-tailed)	.	0.00
		N	128	128
	Market share	Correlation Coefficient	0.68**	1.00
		Sig (2-tailed)	.000	.
		N	128	128
**. Correlation is significant at the 0.01 level (2-tailed).				

- Correlation Coefficient between the two variables is positively correlated via Spearman's Correlation r (128) = 0.68, p <. 001. The correlation coefficient has a small effect due to r (128) = 0.68, but $p < 0.05$ hence correlation is significant and the alternative hypothesis is adopted and the null hypothesis is rejected.

4.6 Hypothesis 3

H1: There is a positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

H0: There is no positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

Table 17: Scale: Descriptive statistics for product and service innovation by item

	Strongly agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %
Has the adoption of ICT levels led to the creation of new products/services?	30%	15%	8%	9%	15%	14%	9%
Has the adoption of ICT levels led the company to be more innovative?	33%	15%	12%	10%	2%	20%	8%

The use of our products/services requires our customers to be ICT savvy	14%	7%	20%	22%	4%	11%	22%
The adoption of ICT has differentiated your products and services in the market	26%	12%	16%	15%	16%	9%	6%

- The table provides a description of how respondents, responded by each item for the products and service innovation scale.

Table 18: Descriptive statistics for Hypothesis 3

Descriptive Statistics

	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Products and Innovation	128	3.50	1.76	0.36	0.21
Valid N (list-wise)	128				

- Mean and standard deviation respectively (*M=3.50, SD=1.76*). The *SD=1.76* is relatively highly compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean.
- The symmetrical distribution of the performance scale has skewness of 0.36 which means the distribution is fairly normal and skewness is not substantial. A small SE 0.21 relative to the *M=3.50* "indicates that most sample means are similar to the population mean and so our sample is likely to be an accurate reflection of the population" (Field, 2013; p.55).

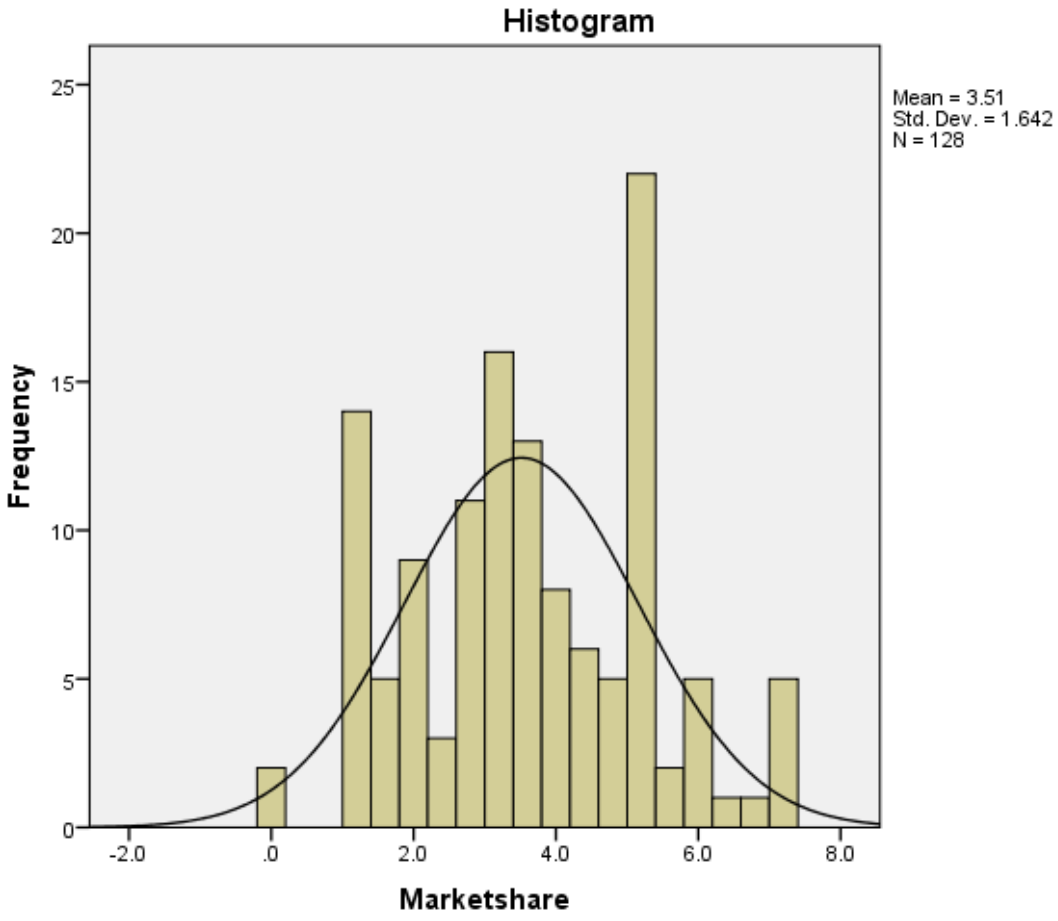

Figure 3: Histogram for Hypothesis 3

- The symmetrical distribution of the performance scale has skewness of 0.36 which means the distribution is fairly normal and skewness is not substantial (GraphPad Software, 2013).

Table 19: Pearson Correlation for Hypothesis 3

Correlations				
			Adoption of ICT	Products and Innovation
Spearman's rho	Adoption of ICT	Correlation Coefficient	1.00	0.71**
		Sig (2-tailed)	.	0.00
		N	128	128
	Products and Innovation	Correlation Coefficient	0.71**	1.00
		Sig (2-tailed)	0.00	.
		N	128	128
**. Correlation is significant at the 0.01 level (2-tailed).				

- Correlation Coefficient between the two variables is positively correlated via Spearman's Correlation r (128) = 0.71, p <. 001. The correlation coefficient has a small effect due to r (128) = 0.71, but $p < 0.05$ hence correlation is significant and the alternative hypothesis is adopted hence the null hypothesis is rejected

4.7 Hypothesis 4

H1: Entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels.

H0: Entrepreneurs who have higher ICT adoption levels do not perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels.

Table 20: Scale: Descriptive statistics for entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels by item

	Strongly agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %
Adoption of ICT levels has improved customer satisfaction.	37%	19%	13%	9%	16%	2%	4%
Our quality of service has improved due to ICT adoption.	37%	16%	13%	8%	19%	3%	4%
Organisation has become more profitable since adopting ICT services.	30%	20%	9%	15%	10%	10%	6%

The use of ICT has led to the creation of new products and services.	30%	14%	6%	15%	21%	6%	8%
Our customer base has increased since adopting ICT services.	38%	13%	9%	20%	11%	4%	5%

- The table provides a description of how respondents, responded by each item for entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels scale.

Table 21: Descriptive statistics for Hypothesis 4

Descriptive Statistics					
	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Perceived Value of ICT Adoption	128	2.87	1.80	0.57	0.21
Valid N (list-wise)	128				

- Mean and standard deviation respectively (*M=2.87, SD=1.80*). The *SD=1.80* is relatively highly compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean.
- The symmetrical distribution of the performance scale has skewness of 0.57 which means the distribution is fairly normal and skewness is not substantial. A small SE 0.21 relative to the *M=2.87*"indicates that most sample means are similar to the population mean and so our sample is likely to be an accurate reflection of the population" (Field, 2013; p.55).

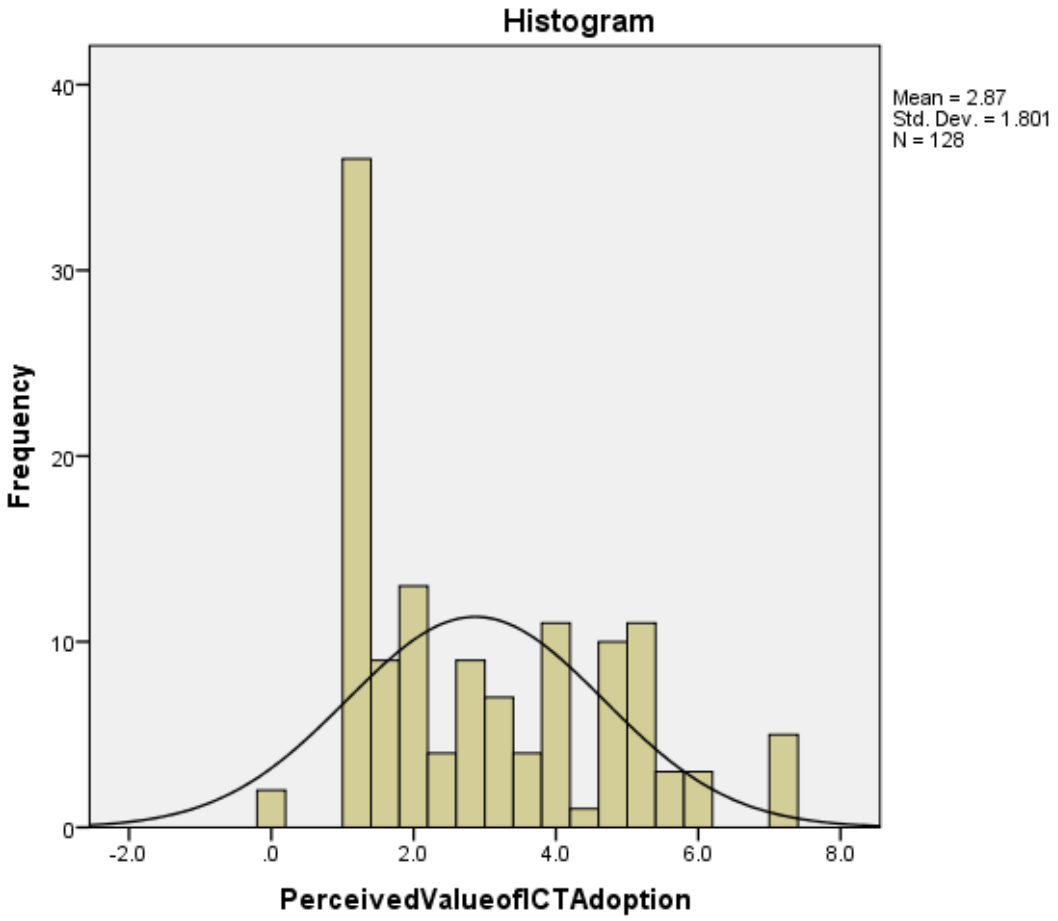

Figure 4: Histogram for Hypothesis 4

- The symmetrical distribution of the performance scale has skewness of 0.57 which means the distribution is fairly normal and skewness is not substantial(GraphPad Software, 2013).

Table 22: Pearson Correlations for Hypothesis 4

Correlations				
			Adoption of ICT	Perceived Value of ICT Adoption
Spearman's rho	Adoption of ICT	Correlation Coefficient	1.00	0.70**
		Sig (2-tailed)	.	0.00
		N	128	128
	Perceived Value of ICT Adoption	Correlation Coefficient	0.70**	1.000
		Sig (2-tailed)	0.00	.
		N	128	128
**. Correlation is significant at the 0.01 level (2-tailed).				

- Correlation Coefficient between the two variables is positively correlated via Spearman's Correlation r (128) = 0.70, p <. 001. The correlation coefficient has a small effect due to r (128) = 0.70, but $p < 0.05$ hence

correlation is significant and the alternative hypothesis is adopted hence the null hypothesis is rejected.

4.8 Employees skills levels to utilise ICT levels

Table 23: Scale: Descriptive statistics for employees' skills level to utilise ICT levels by item

	Strongly agree	Agree	Slightly agree	Neutral	Slightly disagree	Disagree	Strongly disagree
	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %	Row N %
Our organisation is a learning organisation.	30%	14%	15%	20%	5%	11%	5%
Does your staff have the required skills to fully utilise ICT technology?	23%	11%	19%	20%	17%	3%	7%
Does your organisation invest in employee training for them to utilise ICT technology?	21%	13%	15%	20%	12%	10%	9%

Does your organisation test if potential employees have knowledge to use ICT technology before they are hired?	22%	16%	11%	23%	8%	10%	10%
Specific functions in the organisation require employees with ICT knowledge	38%	17%	18%	6%	3%	9%	9%

- The table provides a description of how respondents, responded by each item for employees skills level to utilise ICT levels scale

Table 24: Descriptive statistics for employees' skills levels

Descriptive Statistics					
	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Employees Skills Level to utilise ICT levels	128	3.16	1.64	0.39	0.21
Valid N (list-wise)	128				

- Mean and standard deviation respectively (*M=3.16, SD=1.64*). The *SD=1.64* is relatively highly compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean.
- The symmetrical distribution of the performance scale has skewness of 0.39 which means the distribution is fairly normal and skewness is not substantial. A small SE 0.21 relative to the *M=3.16*"indicates that most sample means are similar to the population mean and so our sample is likely to be an accurate reflection of the population" (Field, 2013; p.55).

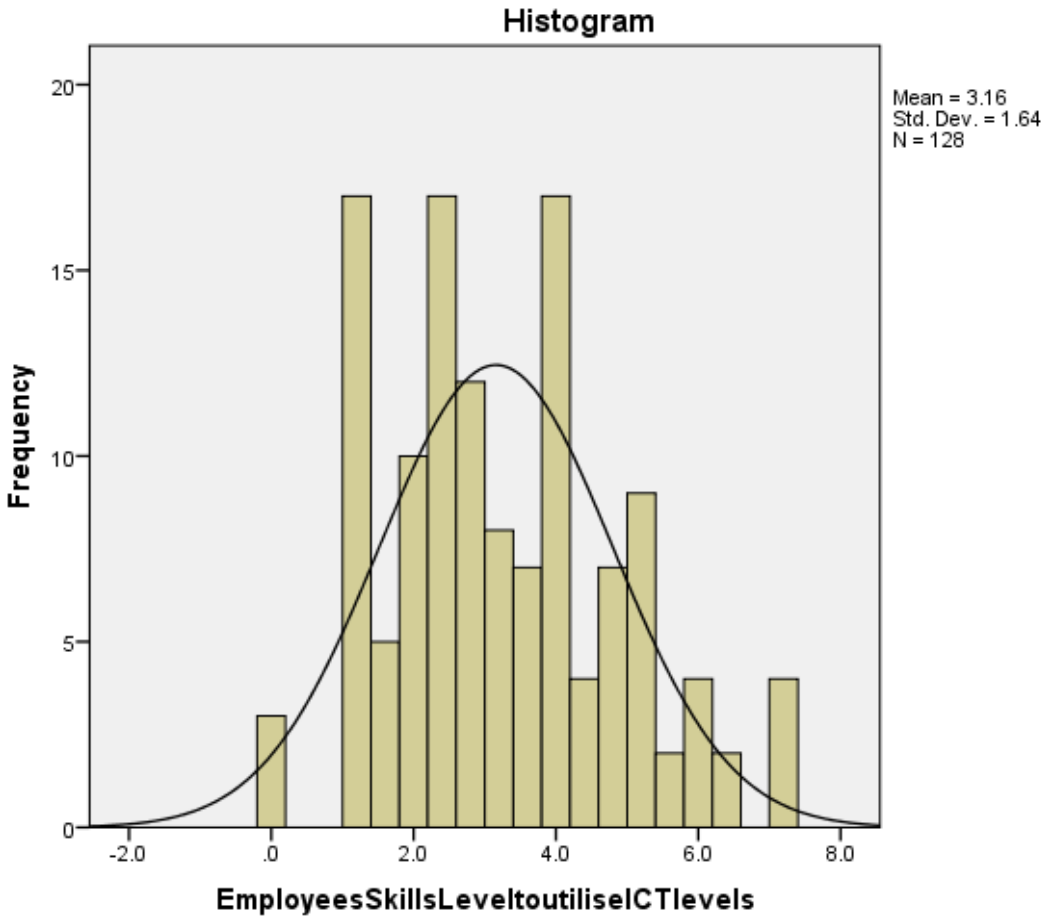

Figure 5: Histogram for employees' skills levels to utilise ICT levels

- The symmetrical distribution of the performance scale has skewness of 0.39 which means the distribution is fairly normal and skewness is not substantial (GraphPad Software, 2013).
-

4.9 Research Question

What are the levels of ICT adoption in the SME manufacturing sector in South Africa?

Table 25: Descriptive statistics for ICT Adoption

Descriptive Statistics					
	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Adoption of ICT	128	3.24	1.66	0.60	0.21
Valid N (list-wise)	128				

- Mean and standard deviation respectively (*M=3.24, SD=1.66*). The *SD=1.66* is relatively highly compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean.

- The symmetrical distribution of the performance scale has skewness of 0.60 which means the distribution is fairly normal and skewness is not substantial. A small SE 0.21 relative to the *M=3.24*"indicates that most sample means are similar to the population mean and so our sample is likely to be an accurate reflection of the population" (Field, 2013; p.55).

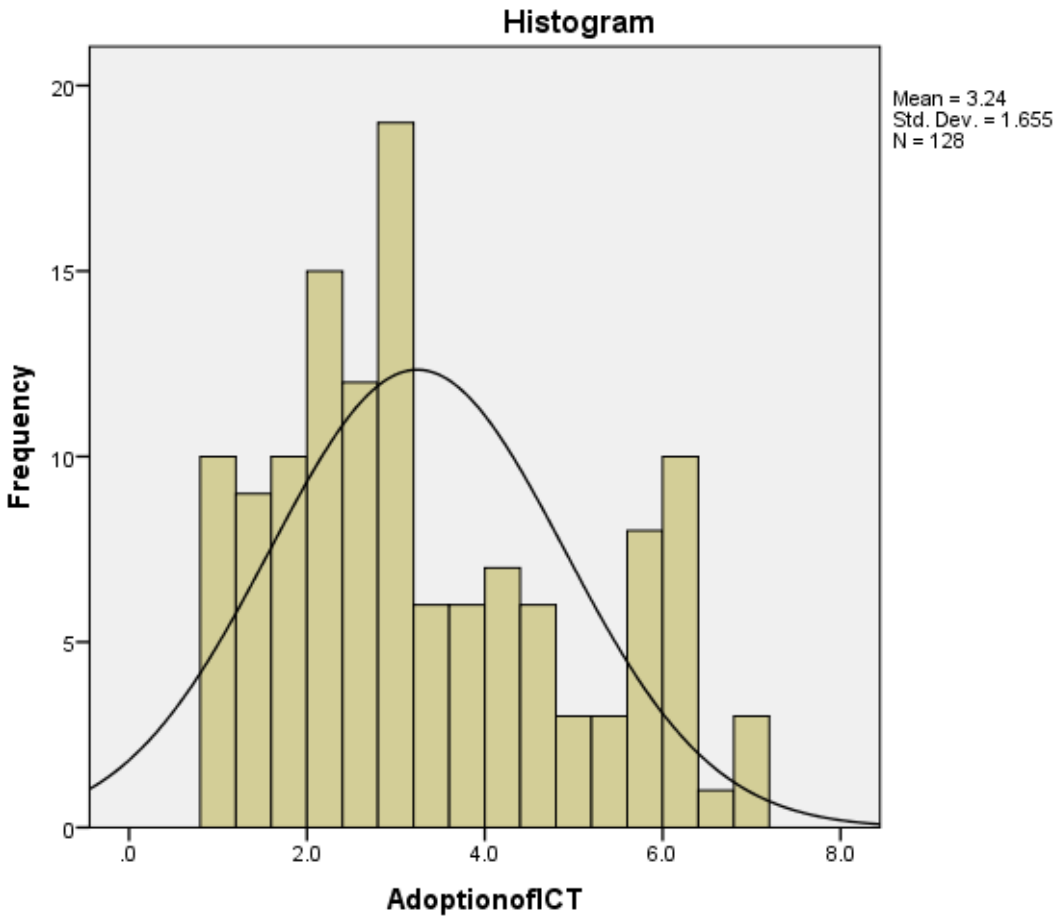

Figure 6: Histogram for ICT adoption

- The symmetrical distribution of the performance scale has skewness of 0.60 which means the distribution is fairly normal and skewness is not substantial.(GraphPad Software, 2013)

The scale for ICT levels provided the following results:

Table 26: ICT levels – Fixed telephone

Our organisation has a fixed telephone.

		Frequency	Percent	Valid Percent
Valid	Yes	124	97	97
	No	4	3	3
	Total	128	100	100

- Most respondents(97%) had access to a fixed telephone

Table 27: ICT levels – Access to Internet

Our organisation has access to Internet.

		Frequency	Percent	Valid Percent
Valid	Yes	125	98	98
	No	3	2	2

	Total	128	100	100

- Most respondents(98%) had access to Internet

Table 28: ICT levels – Access to E-mail

Our organisation has access to E-mail.

		Frequency	Percent	Valid Percent
Valid	Yes	125	98	98
	No	3	2	2
	Total	128	100	100

- Most respondents(98%) had access to E-mail

Table 29: ICT levels – Software in production process

Our organisation utilises software in the manufacturing/production process.

		Frequency	Percent	Valid Percent
Valid	Yes	100	78	78
	No	28	22	22
	Total	128	100	100

- Most respondents(78%) used software in the manufacturing process

Table 30: ICT levels – Fixed Broadband

Our organisation utilises fixed broadband services to communicate

		Frequency	Percent	Valid Percent
Valid	Yes	114	89	89
	No	14	11	11
	Total	128	100	100

- Most respondents (89%) utilise fixed broadband services to communicate

Table 31: ICT levels – Mobile Broadband

Our organisation utilises mobile broadband services to communicate

		Frequency	Percent	Valid Percent
Valid	Yes	99	77	77
	No	29	23	23
	Total	128	100	100

- Most respondents(77%) utilise mobile broadband services to communicate

4.10 Summary of Results

All four hypothesis results were presented. Each hypothesis has descriptive statistics and scale distribution. Linear and nonlinear models were applied where relevant. A summary of the results for each hypothesis was presented. There was evidence of a positive correlation between perceived ICT adoption and all the other four variables namely; perceived performance, market share, products and service innovation and perceived value of ICT level adoption. The results of the research questions were also presented.

CHAPTER 5: DISCUSSION OF THE RESULTS

5.1 Introduction

The focus of this chapter will discuss the findings of the research pertaining to the respective four hypotheses, research question and describe how the outcome of the research supports the literature review. The chapter will also discuss the SME characteristics and conclude with a summary of the findings and related conclusions.

5.2 SME characteristics

As previously mentioned in chapter one, the research will only focus on SMEs in the manufacturing sector in South Africa and hence will exclude SMEs operating in other industry verticals. Furthermore the research will exclude SMEs that already operate within a manufacturing capacity that is within the electronics industry, for example software development, hardware development etc. The research will also exclude micro enterprises and survivalist enterprises as defined in Section 1 of the National Small Business Act of 1996 as amended by the National Small Business Amendment Acts (NSB) of 2003 and 2004. (Mahembe, 2011) and hence limit the study to SME i.e. small medium enterprises.

The demographics of the sample in terms of definition of what was defined as an SME were consistent with the respondent's i.e. annual turnover, number of employees etc. Furthermore careful attention was taken to ensure that the online survey was only sent to SMEs that are not in ICT manufacturing and that the paper questionnaire also excluded SMEs in ICT manufacturing. This was done by confirming each SME's core manufacturing competence via their

respective websites and confirming with the respective respondents. The respondents were mostly the owners of the SME manufacturing entity (49%). The significance of this outcome is that the information provided was mainly from the decision maker of the business which provided credibility to the answers received. The remaining respondents consisted of managers (38%) and employees (13%).

ICT level adoption in relation to general ICT levels and production ICT levels indicates that there is far more adoption at the general ICT level compared to the production ICT levels.

5.3 Hypothesis 1 Discussion:

There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

Hypothesis 1 states that there is a positive monotonic relation between perceptions of ICT adoption and positive firm performance within SMEs in the manufacturing sector in South Africa. The performance scale was a 7-point Likert scale. Descriptive test provided a *M=3.05,* which suggests that the average respondent “slightly agrees” to the perception that ICT level adoption has a positive impact on performance. Performance was normally distributed, with skewness of 0.59(SE 0.21) which means the distribution of results is fairly normal. The *SD=1.73* is relatively high compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean (Field,2013). The adoption of ICT and perceived effects on increasing firm performance were positively correlated via

Spearman's rho, r (128) = 0.81, p < .001. The coefficient correlation had a small effect, p <0.05 hence the alternative hypothesis is adopted.

The findings are consistent with the literature review in terms of ICT adoption and the perceived effects on SME firm performance, specifically in relation to perceived increased productivity, profitability , effectiveness and service quality (Barba-Sanchez,2007; Bigliardi, 2013; Pilat,2004; Raymond, Bergeron & Blili, 2005; Taylor & Murphy, 2004; Marchand, Kettinger, & Rollins, 2001; Ashrafi, Murtaza, 2008).

An analysis of the other variables that have been identified in the literature as contributing to firm performance, namely increased market share, product and service innovation have also provided positive correlations between ICT adoption and perceived performance increase. The finding will be shown later in the research. Have the finding of the results from this study provided similarities to what is in the literature? The results from the study support on-going discussions that the perceived adoption of ICT by SMEs in the manufacturing process has positive results (Baldwin & Sabourin, 2002).

The outcome results are significant therefore we can reject the Null hypothesis and adopt the alternative hypothesis which is:

There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SMEs in the manufacturing sector in South Africa.

5.4 Hypothesis 2 Discussion:

There is a positive monotonic relation between perceptions of ICT adoption and increasing market share within SMEs in the manufacturing sector in South Africa.

Hypothesis 2 states that there is a positive monotonic relation between perceptions of ICT adoption and increase in market share for SMEs in the manufacturing sector in South Africa. The market share scale was a 7-point Likert scale. Descriptive tests provided a *M=3.51,* which suggests that the average respondent "slightly agrees" to the perception that ICT level adoption has a positive impact on market share, but could be leaning towards a "neutral" stance. Market share was normally distributed, with skewness of 1.0(SE 0.21) which means the distribution of results is fairly normal. The *SD=1.64* is relatively high compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean (Field,2013). The adoption of ICT and perceived effects on increasing market share were positively correlated via Spearman's rho, r (128) = 0.68, $p < .001$. The coefficient correlation had a small effect, p <0.05, hence the alternative hypothesis is adopted.

The findings are consistent with the literature review in terms of perceived ICT adoption and an increase in market share, specifically in relation to ability to trade globally, compete with MNC's and differentiate product and service offering (Bigliardi, 2013; Marchand, Kettinger, & Rollins, 2001; Ashrafi, Murtaza, 2008; Baldwin & Sabourin, 2002; Dalotă & Grigore, 2010; Vidas-Bubanja, Grk, & Cvetkovic, 2010). The average respondents had a perception that the adoption of ICT has increased market. This is consistent with the literature which also states that SMEs that incorporate ICT into their operations, have the

potential to trade globally due to the availability of technologies such as access to internet, e-mail, presence via websites which provides the SME with customers on the information highway looking for services regardless of geographic location. Conversely the SME is not limited by location to trade if they adopt the correct enabling ICT solutions (Dhungana, 2003; Uwalomwa & Rant, 2009).

The outcome results are significant therefore we can reject the Null hypothesis and adopt the alternative hypothesis which is:

There is a positive monotonic relation between perceptions of ICT adoption and increasing market share within SMEs in the manufacturing sector in South Africa.

5.5 Hypothesis 3 Discussion:

There is a positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

Hypothesis 3 states that there is a positive monotonic relation between perceptions of ICT adoption and the level of product and service innovation for SMEs in the manufacturing sector in South Africa. The products and service innovation scale was a 7-point Likert scale. Descriptive tests provided a *M=3.50,* which suggests that the average respondent “slightly agrees” to the perception that ICT level adoption has a positive impact on product and service innovation, but could be leaning towards a “neutral” stance. Product and service innovation scale was normally distributed, with skewness of 0.36(SE

0.21) which means the distribution of results is fairly normal. The *SD=1.76* is relatively high compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean (Field,2013). The adoption of ICT and perceived effects on product and services innovation were positively correlated via Spearman's rho, r (128) = 0.71, $p < .001$. The coefficient correlation had a small effect, $p < 0.05$ hence the alternative hypothesis is adopted.

The findings are consistent with the literature review in terms of the perceived effect of ICT adoption and the level of product and service innovation, specifically in relation to creation of new products, increased innovation and product and service differentiation. (Spiezia, 2011; Ashrafi & Murtaza, 2008). In their findings Chan, Huff, Barclay & Copeland (1997) argue that firm performance also includes other elements such as improvements in product and service innovation by adopting ICT. The findings of this research provided positive correlations between ICT adoption and the perceived product and service innovation.

The outcome results are significant therefore we can reject the Null Hypothesis and adopt the alternative hypothesis which is:

There is a positive relationship between ICT adoption and the level of product and service innovation within SMEs in the manufacturing sector in South Africa.

5.6 Hypothesis 4 Discussion:

Entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels.

Hypothesis 4 states that entrepreneurs who have higher ICT adoption levels perceive a greater impact on performance than those who have lower ICT adoption levels. The scale for entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels was a 7-point Likert scale. Descriptive tests provided a *M=2.87,* which suggests that the average respondent "agrees" to the perception that entrepreneurs with higher ICT level adoption perceive a greater impact on firm performance than those with lower adoption levels. The scale was normally distributed, with skewness of 0.57(SE 0.21) which means the distribution of results is fairly normal. The *SD=1.80* is relatively high compared to the mean which means the responses ranged from strongly agree to strongly disagree, hence the responses were not close to the mean (Field,2013). The adoption of ICT and entrepreneurs with higher ICT adoption levels perceive a greater impact on firm performance than those with lower adoption levels were positively correlated via Spearman's rho, r (128) = 0.70, p < .001. The coefficient correlation had a small effect, p <0.05, hence the alternative hypothesis is adopted.

The findings are consistent with the literature review in terms of entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels, specifically in relation to customer satisfaction, quality of service, profitability, product and service innovation and increased market share (Ashrafi, Murtaza, 2008; Marchand,

Kettinger, & Rollins, 2001; Taylor & Murphy, 2004; Bigliardi, 2013; Pilat, 2004; Ismail, Jeffery, & Belle, 2011). The literature is also very explicit in terms of ICT adoption by SMEs who utilise advanced ICT by arguing that SME's who have adopted "advanced" ICT technology are "associated with higher productivity growth" (Pilat, 2004; p.50). The average respondent in this research "agreed" with the perception that higher ICT adoption had a greater impact on firm performance. These findings are consistent and reliable in terms of the general literature.

The outcome results are significant therefore we can reject the null hypothesis and adopt the alternative hypothesis which is:

Entrepreneurs who have higher ICT adoption levels perceive a greater impact of ICT levels on performance than those with lower ICT adoption levels.

5.7 Employees skills level to utilise ICT levels:

The scale was designed to measure if employees have the skills to utilise ICT levels. The scale was a 7-point Likert scale. Descriptive tests provided an *M=3.16,* which suggests that the average respondent "slightly agrees" that the employees in their organisations have the correct levels of skills to utilise ICT levels. Scale was normally distributed, with skewness of 0.39 (SE 0.21) which means the distributions of results are fairly normal. The *SD=1.64* is relatively high compared to the mean which means the responses ranged from strongly agree to strongly disagree; hence the responses were not close to the mean (Field,2013).

The findings are consistent with the literature review in terms of employee's skills levels to utilise ICT levels, specifically in relation to the SME being a learning organisation, investing in ICT training for staff to utilise ICT levels and screening for ICT level competence at the interview stage (Barba-Sanchez, 2007; Pilat, 2004; Vidas-Bubanja et al, 2010). Furthermore the literature is clear on the relation between ICT adoption and positive firm performance being linked to correctly skilled employees who can utilise the technology efficiently. The SME also needs to invest in continuous training for their employees in order to ensure they (employees) are kept up to date with developments in technology upgrades which could affect how technology is utilised in the manufacturing process.

5.8 Research Question: What are the levels of ICT adoption in the SME manufacturing sector in South Africa?

The ICT adoption scale was designed to understand what influences ICT level adoption by SMEs in manufacturing. The scale was a 7-point Likert scale. Descriptive tests provided a *M=3.24*.The scale was normally distributed, with skewness of 0.66 (SE 0.21) which means the distribution of results is fairly normal. The *SD=1.66* is relatively high compared to the mean which means the responses ranged from strongly agree to strongly disagree, hence the responses were not close to the mean (Field, 2013).

The research question had two scales that were supposed to assist in finding an answer to the research question. The first scale measured the ICT levels i.e. the level of ICT investment in the SME. In other words did the SME have ***general ICT usage*** , for example internet, email; ***production ICT usage*** , for example accounting, production, CRM software etc. and ***advanced ICT usage*** , for example mobile payments, mobile CRM etc. (Ismail et al., 2011). The

scale to measure ICT levels was a yes or no scale and the data response was ranked by level i.e. both ***general ICT usage*** and ***production ICT usage*** being high. The scale did not test to measure the advanced ICT levels.

The findings reveal that there is high adoption of general ICT usage with internet access and e-mail access displaying 98% adoption while fixed telephony had 97% adoption. Fixed broadband adoption was 89% which was higher than mobile broadband adoption at 77%. The use of ICT products and services in the manufacturing process had an adoption of 78% which indicates that there is still some room to improve adoption of ICT within the manufacturing and production process. Furthermore there is also room to improve the adoption of mobile broadband within SMEs in manufacturing in South Africa. The research finding of respondents in this study reveals that there is high adoption for general ICT and production usage ICT.

The findings are consistent with the literature review in terms ICT level adoption being influenced by the SMEs having a strategy, budget, skilled workforce and a culture to adopting new technologies (Wolf, 2001; Modimogale & Kroeze, 2011; Ashrafi &Murtaza, 2008; Barba-Sanchez,2007; Ritchie & Brindley, 2005).

5.9 Conclusion

The four hypothesis presented seem to provide significant perceived relations between ICT adoption and the perceived effects on performance, market share, product and service innovation and perceived high ICT levels with greater impact in performance. Although the findings positively correlate, across the respective hypothesis, a majority of the means were “slightly agree” which could suggest that SMEs in manufacturing in South Africa need to evaluate the importance of ICT adoption on firm performance.

The two sub problems have supporting evidence i.e.:

- *Measure the adoption of ICT levels within the SME manufacturing sector in South Africa.*
- *Evaluate the perceived impact of ICT level adoption on performance within the SME manufacturing sector in South Africa.*

The findings of the research are consistent with the literature review.

CHAPTER 6: CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

6.1 Introduction

This section will provide a discussion around the conclusions of the study as well as the recommendations identified based on the outcome of the research. Suggestions for further research which could be elaborated on in detail that did not form part of this current research will also be discussed.

6.2 Conclusions of the study

The adoption of ICT and the perceived impact on performance within SMEs in manufacturing in South Africa revealed some consistent findings with existing literature in terms of the overall accepted perception that ICT adoption has a perceived positive impact on firm performance including but also not limited to market share, products and service innovation etc. as measured in the research. What is apparent though is that the descriptive statistics across the four hypothesis all provided a *M=3.0* except for Hypothesis 4 which had a *M=2.87*. This indicates that most of the respondents on average “slightly agree” that ICT adoption improves form performance. I would have expected a much more significant response leading towards “agree” and “strongly agree”. The correlation coefficients all had a small effect i.e. r -/+ 1 albeit there being a perfect positive relationship between ICT adoption and the other

variables. Due to a small sample size and time constraints the study could not do further analysis such a regressions and factor analysis.

The outcome may be further supported by the literature which mentions that adoption of ICT within SME's has not produced the expected adoption rates due to barriers such as the readiness to adopt new technologies which could encompass the complexity of the technology and the lack of skill within the SME organisation to understand and implement the technology (Ritchie & Brindley, 2005). Furthermore, the perceived high sets up costs are also seen as barriers to ICT adoption. This view is mentioned by Modimogale and Kroeze (2011) when they argue that "ICT solutions are generally associated with millions of rands and stories of ICT solutions are synonymous with running over budget" (p.4).

A deeper analysis is required to understand why the respondents in the research did not *overwhelmingly* state that ICT adoption has a perceived positive impact on performance, market share, product and service innovation etc. Could the findings be related to the study being limited to a majority of SMEs in manufacturing in Johannesburg i.e. Strydom Park and Kya Sands?

6.3 Recommendations

The significance of this study is that it does provide insight into the perceptions of SME manufactures in South Africa and how the adoption of ICT may impact on firm performance. The outcome of the study does demonstrate that the average respondent perceives ICT adoption to

have a positive impact on firm performance. Although there correlation coefficients of ICT adoption and performance, market share, product and service innovation etc. produced a perfect positive relationship, the correlation coefficients all had a small effect.

The research can be used by existing entrepreneurs and those seeking to start their own ventures on the perceived impact ICT adoption has on firm performance. The research does not provide overwhelming support for ICT adoption and firm performance, but does provide sufficient evidence that the adoption of ICT by SMEs in the manufacturing sector in South Africa is perceived to have a positive impact on performance. The outcome of the research does provide insight into where most SMEs in manufacturing are investing the ICT spend i.e. general ICT usage and production –orientated usage. This suggests that the SMEs find it important to have access first to internet, e-mail etc. then followed by ICT that assists in the production process.

The challenge is to understand why ICT adoption and firm performance in the SME manufacturing sector in this study did not produce an overwhelming correlation. The reasons to this are vast and this is where the study was limited in terms of understanding all possible variables that may improve the perceived adoption of ICT and the positive impact on performance.

6.4 Suggestions for further research

Scholars could expand the current research by expanding the sample frame to SMEs in manufacturing across South Africa and not limit it to Johannesburg as this study did. Furthermore the research could expand more on the SME entrepreneur's intentions to adopt ICT. The current research was a combination of the technological and management

perspectives i.e. the research mainly focused on how ICT was being utilised and the perception of how successful the usage of ICT is on the SME; “understand the small firms strategic approach to using IT …” (Southern & Tilley, 2000; p. 141). The Entrepreneurs perspective on gaining a deeper understanding why he/she would adopt technology in the manufacturing process and the perceived impact on firm performance within a SME manufacturing context is still open to be explored. Furthermore, there is an opportunity to explore the adoption of advanced ICT as this was not explored in this research.

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APPENDIX A: QUESTIONNAIRE

Demographics

How many employees are employed by your firm?

Fewer or equal to 50	
Great than 51 but fewer than 100	
Greater than 101 but fewer than 200	

What is the annual turnover of your business?

Between R2m and R25 m	
Between R4m and R50 m	

In relation to your competitors, how much market share do you control? (State market share in %)

0% to 2%	
>2% to 4%	
>4% to 8%	
>8% and above	

What best describes your role within your firm?

Owner	
Manager	
Employee	

Levels of ICT

Definition of ICT:

ICT is the use of technologies (computers, smartphones, software) that facilitate the processing, transferring and communicating of information in a digital manner. ICT also encompasses the level of adoption i.e. how the technology is utilised either as a support administrative function (email, accounting software) or utilised in the production of goods and services or part of a business process.

Our organisation has a fixed telephone.

Yes	
No	

Our organisation has access to Internet.

Yes	
No	

Our organisation has access to E-mail.

Yes	
No	

Our organisation utilises software in the manufacturing/production process.

Yes	
No	

Our organisation utilises fixed broadband services to communicate

Yes	
No	

Our organisation utilises mobile broadband services to communicate

Yes	
No	

Adoption of ICT

Our organisation has a clear ICT strategy.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Our organisation has skilled people who can work with different types of ICT levels.

(I.e. Internet access, e-mail l, Accounting software, Inventory software, CAD software etc.)

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

The organisational culture embraces new technology.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

ICT purchasing decisions are done in consultation with experts and/or feedback from the social/professional network.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Our organisation budgets for ICT purchases

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Performance

The adoption of ICT levels has increased productivity?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption of ICT levels increased profitability?

(Profitability calculated as (Sales – Cost of sales – less expenses(EBITA))?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption of ICT levels improved effectiveness?

(Since adopting technology your organisational tasks are easier)

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Does your staff have the required skills to fully utilise ICT technology?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

The adoption of ICT levels has improved the quality of our products and services.

(Since adopting ICT levels the quality of our products/services has improved)

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Market Share

Has the adoption of ICT levels increased your market share locally?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption of ICT levels enabled your firm to trade globally?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption ICT levels differentiated your service from your competitors?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption of ICT levels enabled you to compete with Multinational Corporations?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption of ICT levels by your competitors given them competitive advantage?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Products and Service Innovation

(Since adopting ICT levels has your organisation has been able to offer products and services that are not offered by your competitors? i.e. your organisation has a unique product or service.)

Has the adoption of ICT levels led to the creation of new products/services?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Has the adoption of ICT levels led the company to be more innovative?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

The use of our products/services requires our customers to be ICT savvy

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

The adoption of ICT has differentiated your products and services in the market

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Perceived Value of ICT Adoption

(Since adopting ICT levels there has been an increase in customer satisfaction, improved service to customers, organisation more profitable, creation of new products and services, increased market share.)

Adoption of ICT levels has improved customer satisfaction.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Our quality of service has improved due to ICT adoption.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Organisation has become more profitable since adopting ICT services.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

The use of ICT has led to the creation of new products and services.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Our customer base has increased since adopting ICT services.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Employees skills level to utilise ICT levels

Are your employees equipped to use ICT levels i.e. do they have the necessary skills?

Does your organisation embrace and up-skill itself when technology evolves?

Our organisation is a learning organisation.

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Does your staff have the required skills to fully utilise ICT technology?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Does your organisation invest in employee training for them to utilise ICT technology?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Does your organisation test if potential employees have knowledge to use ICT technology before they are hired?

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

Specific functions in the organisation require employees with ICT knowledge

	1	2	3	4	5	6	7	
Strongly Agree								Strongly Disagree

APPENDIX B: CONSISTENCY MATRIX

Consistency matrix

Measure the adoption of ICT usage and the perceived impact on performance within the SME manufacturing sector in South Africa.					
Sub-problem	**Literature Review**	**Hypotheses or Propositions or Research questions**	**Source of data**	**Type of data**	**Analysis**
Sub-Problem 1 *Measuring the adoption of ICT services within SME manufacturing sector in South Africa*	*Zuppo, C. M (2012). Defining ICT in a boundaryless world: the development of a working hierarchy. International Journal of Managing Information Technology, 4(3).* *Modimogale, L., & Kroeze, J. H (2009). Using ICTs to become a competitive SME*	*What are the levels of ICT adoption in the SME manufacturing sector in South Africa?*	Questionnaire/ Online survey	Nominal	Mean and Standard Deviation

	in South Africa. *Pierson, J., Baelden, D., Lievens, B., & Marsigny, C (2009). Analysing Sector Specificity Regarding ICT and Broadband Usage by SMME Businesses. The Southern African Journal of Information and Communication, 8, 154 -171.* *Southern, A., & Tilley, F (2000). Small firms and information and communication technologies (ICTs): toward a typology of ICTs usage. New technology, work and employment, 15(2), 138-154.* *Wolf, S (2001). Determinants and impact of ICT use*				

	for African SMEs: Implications for rural South Africa. Paper presented at the 2001 Annual Forum. Centre for Development Research (ZEF Bonn), Bonn University, TIPS. http://www. tips. org. za/f2001/wolf. pdf Diversifying participation in network development. *Barba-Sanchez, B. M.-R., MDL. Jimenez -Zarco, A I (2007). Drivers, Benefits and Challenges of ICT Adoption by Small and Medium Sized Enterprises (SMEs): A Literature Review. Problems and Perspectives in Management, 5(1), 103 -114.*				

	Ritchie, B., & Brindley, C (2005). ICT adoption by SMEs: implications for relationships and management. New technology, work and employment, 20(3), 205-217. *Modimogale, L.,* *& Kroeze, J. H (2011). The Role of ICT within Small and Medium* *Enterprises in Gauteng. Communications of the IBIMA, 2011.* *Ismail, R., Jeffery, R., & Belle, J.-P. V (2011). Using ICT as a Value Adding Tool in* *South African SMEs. Journal of African Research in Business &*				

	Technology(2011) , 1-12.				
Sub-Problem 2 Evaluate the perceived impact of ICT adoption on performance within the SME manufacturing sector in South Africa.	*Taylor, M., & Murphy, A. (2004). SMEs and e-business. Journal of Small Business and Enterprise Development, Volume 11(3), 280 - 289.* *Pilat, D (2004). The ICT productivity paradox: insights from micro data. OECD Economic Studies, 38(1), 37-65.* *Moodley, S (2003). The challenge of e-business for the South African apparel sector. Technovation, 23, 557–570.*	**Hypothesis 1** *There is a positive monotonic relation between perceptions of ICT adoption and increasing firm performance within SME's in the manufacturing sector in South Africa.* **Hypothesis 2** *There is a positive monotonic relation between ICT level adoption and increasing market share within SME's in the manufacturing sector in South Africa.*	Questionnaire/ Online survey	Ordinal/ Interval	Descriptive statistics, frequencies, Histograms, Spearman's Correlation, Mean and Standard deviation.

	Moodley, S (2003). Whither business-to-business electronic commerce in developing economies? The case of the South African manufacturing sector. Information Technology for Development, 10, 25–40. *Mokaya, S. O (2012). The Adoption of Information and Communication Technology by Small Enterprises in Thika Municipality, Kenya. International Journal of Business and Social Science, 3(3), 172 -178.* *Marchand, D., Kettinger, W., & Rollins, J (2001).*	**Hypothesis 3** *There is a positive monotonic relation between ICT level adoption and the level of product and service innovation within SME's in the manufacturing sector in South Africa.* **Hypothesis 4** *Entrepreneurs who have higher ICT adoption levels* ***perceive*** *a greater impact of ICT levels on performance than those with lower ICT adoption levels.*			

	Information Orientation The link to Business Performance: Oxford University Press. *Ismail, R., Jeffery, R., & Belle, J.-P. V (2011). Using ICT as a Value Adding Tool in* *South African SMEs.* *Spiezia, V (2011). Are ICT Users More Innovative? An Analysis of ICT-Enabled Innovation* *in OECD Firms. OECD Journal: Economic Studies, 99 -119.*				